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NETWORKS OF CENTRES OF EXCELLENCE

CANADA RESEARCH CHAIRS

ONTARIO INNOVATION TRUST

ONTARIO RESEARCH AND DEVELOPMENT CHALLENGE FUND

PREMIER'S RESEARCH EXCELLENCE AWARDS

ONTARIO CENTRES OF EXCELLENCE

A Sampling of

Success Stories

of

Federal and Provincial Investment in University Research

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Research Success Stories

April 2004

The Ontario Council on University Research is pleased to present the third edition of Research *Success Stories*.

These stories celebrate the dedication, hard work, and achievements of faculty and students at Ontario's public universities, and demonstrate the critical importance of the research funding programs of the federal government and the Ontario government.

The stories give substance to the assertion that university research plays an essential role in the advancement of knowledge and in Ontario's and Canada's economic, social and cultural development, and contributes immeasurably to improvements in the quality of life and health of our citizens.

Federal programs that have contributed to the leading-edge research described in these stories include the **Canada Foundation for Innovation**, the **Canada Research Chairs** program, and the **Networks of Centres of Excellence**, as well as the three research funding councils: the **Natural Sciences and Engineering Research Council**, the **Canadian Institutes of Health Research**, and the **Social Sciences and Humanities Research Council**. Programs funded by the Ontario government include the **Ontario Innovation Trust**, the **Ontario Research and Development Challenge Fund**, the **Premier's Research Excellence Awards**, and the **Ontario Centres of Excellence**.

A brief description follows of key features of these programs, including private sector partnerships and university contributions. The funding profiles in several of the stories acknowledge contributions from other government programs, departments and ministries, as well as agencies, foundations, industries, and businesses that have contributed to university research to help secure a competitive, prosperous and healthy future for this province and country.

Ontario universities are very grateful for the funding that has allowed the researchers profiled here to demonstrate their commitment to discovery and innovation.

Dr. Paul Guild
Chair, Ontario Council on University Research
Vice-President of Research, University of Waterloo

Key Federal and Provincial Research Funding Programs

In addition to the programs of three federal research granting councils—the **Natural Sciences and Engineering Research Council (NSERC)**, the **Canadian Institutes of Health Research (CIHR)**, and the **Social Sciences and Humanities Research Council (SSHRC)**—federal programs frequently cited in *Success Stories* include:

Canada Foundation for Innovation (CFI): Established in 1997, the **CFI** provides support on a competitive basis for the development of research infrastructure at universities, hospitals, research institutes, and colleges. The **CFI** supports 40% of project costs and recipients must raise the remaining 60% from other sources, including provincial programs and the private sector. For Ontario projects, the **Ontario Innovation Trust** matches the **CFI** contribution. Website: *www.innovation.ca*

Canada Research Chairs (CRC) Program: This program was introduced in 2000 to support the establishment of 2,000 Chairs in Canadian universities by 2005. Tier I Chairs are awarded to experienced star researchers who will receive $200,000 annually for seven years, renewable for any number of terms. Tier II Chairs are awarded to exceptional emerging researchers, who will receive $100,000 annually for five years, renewable once. Website: *www.chairs.gc.ca*

Networks of Centres of Excellence (NCE) Program: **NCE**s, which are funded through the budgets of the three federal granting councils, foster research partnerships among universities, industry, and government to develop the economy and improve the quality of life of Canadians. Currently, there are 21 networks, nine of them led by Ontario institutions. Website: *www.nce.gc.ca*

Ontario Government programs often cited in the stories include:

Ontario Research and Development Challenge Fund (ORDCF): The **ORDCF** was established in 1997 to competitively select and support leading-edge research initiatives of interest to the private sector. Initially, the ORDCF contributed one-third of total project costs, and private sector partner(s) and the university each contributed one-third of the total. Currently, the **ORDCF** supports 22% of total project costs while the university contributes 44%. The private sector partners still contribute at least one-third.
Website: *www.ontariochallengefund.com*

Ontario Innovation Trust (OIT): The **OIT** was established in 1999 to fund research infrastructure projects of importance to the province. It is the main vehicle for matching the **CFI**'s contribution to Ontario projects, generally supporting 40% of project costs. Thus, for projects supported by the **CFI** and **OIT**, Ontario universities must raise 20% of project costs from other sources.
Website: *www.oit.on.ca*

Premier's Research Excellence Awards (PREA): The **PREA**s provide support for promising young researchers to hire graduate students and post-doctoral students for their research programs. Recipients are selected competitively and usually are awarded about $150,000. Two-thirds of this funding, or up to $100,000, is provided by the Ontario government, while the university provides the remaining $50,000 through funds raised from the private sector. Website: *http://www.ontariocanada.com/ontcan/en/rts/rts_prea.jsp*

Ontario Centres of Excellence (OCE) Program: This program was established in 1987 to train and develop researchers and encourage the transfer and diffusion of technology. Currently there are four Centres, each consisting of a consortium of industry and university research units with recognized international excellence in science. The Ontario government provides total annual funding of $32.2 million. Website: *www.oce-ontario.org/*

Ontario universities also acknowledge the contribution of the federal Indirect Costs program and the Ontario Research Performance Fund to the indirect costs of the research supported by these programs.

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Brock University

Careers begin here!

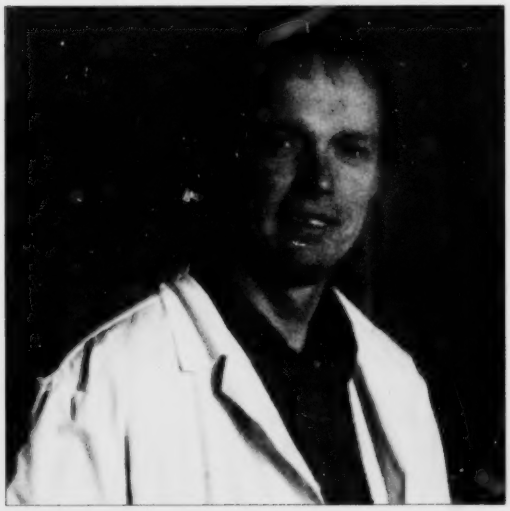
Unlocking the Power of Photosynthesis

ALL LIFE ON EARTH requires photosynthesis, the chemical process that provides the energy needed by every living organism. Photosynthesis occurs when plants, algae and certain types of bacteria use light to convert carbon dioxide and water into energy-rich compounds and oxygen. The part of the process that interests Dr. Art van der Est, Associate Professor in Brock's Department of Chemistry, is the ability of plants to capture and convert light energy from the sun and then store it until it is needed. Specifically, he is researching the "structure and function of photosynthetic reaction centres and porphyrin-based model systems."

Dr. van der Est's research focuses on two separate but related aspects of photosynthesis: directionality of electron transfer in Photosystem I, and the factors governing electron transfer through the quinone acceptors in Photosystem I. "If we know how the reaction works, then we would know how to mimic it, which would be a major step toward the development of more efficient ways of collecting solar energy," he explains.

Using a technique called Transient Electron Paramagnetic Resonance spectroscopy, Dr. van der Est measures light-induced spin polarization from photosynthetic organisms to determine the rate of electron transfer in the reaction centres and give details of the interaction of the molecules involved in the electron transfer with their surroundings.

This work brings together a unique combination of expertise in magnetic resonance spectroscopy, state of the art molecular biology, biochemistry and photochemistry.



Dr. Art van der Est's research into photosynthesis may lead to future energy efficiencies.

funding profile

Natural Sciences and Engineering Research Council	$44,177
	$165,000
Canada Foundation for Innovation	$74,000
Ontario Innovation Trust	$74,000
Premier's Research Excellence Award	$150,000 *

* Two-thirds of each PREA is funded by the province and one-third is provided by the university.

Brock University

Careers begin here!

The Broad Spectrum of Human Sexuality

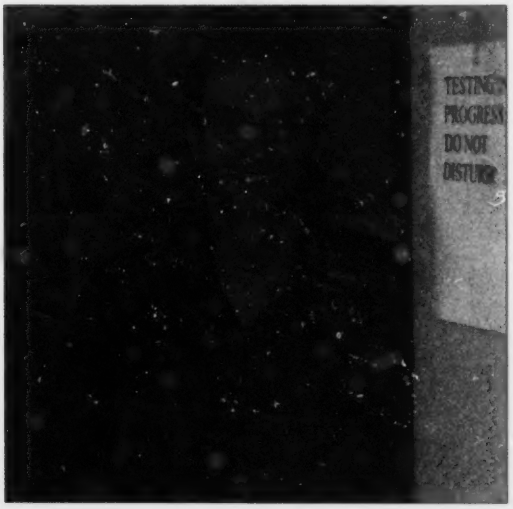
THE STUDY OF human sexuality has tremendous implications for health and well-being, says Tony Bogaert, Associate Professor in Brock's Department of Community Health Sciences. "Most of society is impacted by human sexuality issues," he says. The field has experienced a renaissance in the last 10 years.

Dr. Bogaert is a leading scholar in the field of sexology with a specific focus on the relationship of birth order to sexual orientation, and has been awarded the Brock Chancellor's Chair to continue this important work. Termed the "older brother effect," Dr. Bogaert's findings suggest that birth order and sexual orientation development seem to correlate reliably in men. He explains, "Gay men tend to be later born; specifically, they have more older brothers than heterosexual men. However, there does not seem to be any correlation between birth order and sexual orientation development in women."

The breadth of Dr. Bogaert's research is considerable, including sexual offenders, pornography, sexual anatomy, methodological issues in sex research, high-risk sexual behaviour such as sexually transmitted diseases and other bio-demographic factors related to sexual orientation. Dr. Bogaert is also a co-collaborator in the Youth Lifestyles Choices/Community-University Research Alliance project studying youth resiliency and positive lifestyle choices in adolescence.

Taking an eclectic, interdisciplinary approach to sexology suits Dr. Bogaert's many interests. "I feel that there are an enormous number of things that have the potential for investigation."

▼ Dr. Tony Bogaert is exploring the connection between birth order and sexual orientation.



funding profile

◗ Social Sciences and Humanities Research Council	$138,463
◗ Social Sciences and Humanities Research Council/Community-University Research Alliance (Co-Collaborator)	$400,000

Brock University
Careers begin here!

Brain-Behaviour Relationships in the Aftermath of Traumatic Brain Injury

THE HUMAN BODY has done a wonderful job of building a home for the brain. Gently cushioned by shock-absorbing cerebral spinal fluid and sheltered in a bone enclosure, the brain is safe from most of the dangers of daily living. Unfortunately, the cranium cannot sufficiently protect the brain from high-velocity impact injuries, such as those that could be inflicted by a motor vehicle collision or from the gradual changes associated with normal aging.

Dr. Jane Dywan, Professor of Psychology, is a clinical psychologist with a specialty in neuropsychology. Her research focuses on the interface between brain function and various aspects of attention and memory. One line of research involves the persistent difficulties experienced by people with mild to moderate trauma to the brain and/or brainstem. This research is providing insight into how the brain responds to traumatic injury and demonstrates how to best conceptualize the behavioural changes experienced in everyday life. She explains, "The more we learn and understand about the connection between brain function and behaviour, the more efficiently and compassionately we can work with injured individuals and their families to ensure the fullest functional recovery possible and the richest possible quality of life."

Another area of Dr. Dywan's research involves age-related changes in cognitive function as they occur in healthy older adults, with a focus on the relationship between a decline in attentional control and the ability to monitor the source of remembered events. Her work in both fields combines theoretically driven behavioural measures with some of the most recent advances in EEG technology as well as other indices of physiological function. In both cases, Dr. Dywan, along with her students and colleagues, is finding important links between general physiological arousal (which can change with age or injury) and various aspects of attentional allocation (which can affect the degree of cognitive decline).

Dr. Jane Dywan, (foreground) pictured in the Experimental Recording Room with PhD candidate Karen Mathewson (standing), MA student Sonia Sanichara and research assistant James Desjardins demonstrating the Electric Geodesic Sensor Net.

funding profile

- **Natural Sciences and Engineering Research Council** — **$74,000**

Brock University

Careers begin here!

Assumptions, Approaches and Interventions in International Politics

UNDERSTANDING THE NUANCES of international politics requires "patience, understanding and time to comprehend what others are saying," says Associate Professor Pierre Lizée in Brock's Department of Political Science. For the past six years, he has studied the theoretical, policy and empirical spheres of "failed states"—countries such as Haiti where institutional structures have collapsed.

"The countries I examine are areas where there is extreme poverty and violence," he says. "Often the intervention by other countries or organizations such as the United Nations is based on reconstruction and development." Reconstruction usually consists of an aid plan to restart the economy, including the promotion of elections, the rule of law and legal reforms. Because similar operations were carried out there, Cambodia is one of the countries to which Dr. Lizée has devoted significant scrutiny. His book, *Peace, Power and Resistance in Cambodia: Global Governance and the Failure of International Conflict Resolution*, examines both the failure of the 1993 Paris Plan and the long-term effects of the approaches used by the international community in multilateral peace operations.

In addition to his international policy efforts, Dr. Lizée is a consultant with the Department of Foreign Affairs and International Trade on matters related to Canadian foreign policy in Southeast Asia. He is also Co-Director of a three-year project funded by the **Canadian International Development Agency** to examine how civil society can participate in the construction of national and regional security.

Dr. Pierre Lizée is studying international policy efforts in countries where institutional structures have failed.

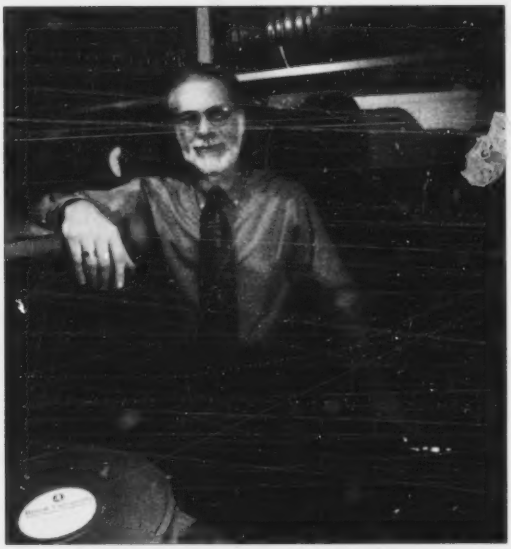
funding profile

◗ Canadian International Development Agency	$2.3 million
◗ Ford Foundation	$15,000

Brock University

Careers begin here!

Brock Professor Involved in a Variety of Pop Culture Projects



Dr. Barry Grant is conducting research into the American Western film genre.

DR. BARRY GRANT, Professor in Brock's Department of Communications, Popular Culture and Film and Director of the Master's Program in Popular Culture, is busy these days. He is involved in a number of research projects, including a critical overview of the American Western that involves detailed readings of eight important Western films, conducting first-hand research at sites such as Monument Valley, and investigating popular music, literature, cultural mythology and Western art.

Dr. Grant edits film books for two university presses and is an internationally recognized expert on popular cinema. He has published extensively on popular cinema, with an emphasis on genre and documentary, as well as on topics of popular music, science fiction and the fantastic in literature and film. Dr. Grant currently serves as Editor-in-Chief of the *Schirmer Encyclopaedia of Film*.

A book called *Five Films of Frederick Wiseman* is another of Dr. Grant's many projects. It features transcriptions of the documentaries *High School*, *High School II*, *Titicut Follies*, *Public Housing* and *Welfare*, as well as a critical introduction dealing with Wiseman's work. He explains, "Wiseman's films allow for considerable interpretive play on the part of viewers. Part of my challenge in the transcription process is to be descriptive about shots without being selective, which of course is inherently interpretive."

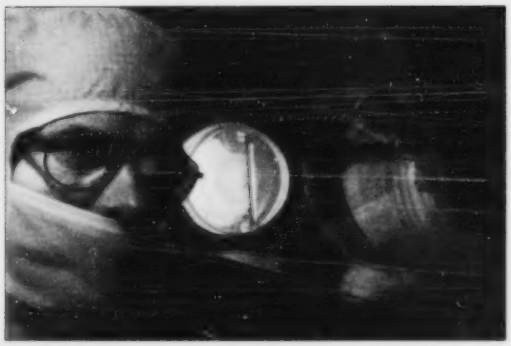
Popular Culture Niagara is a collaborative research project with seven other faculty in which Dr. Grant is also involved. The group is researching aspects of popular culture in Niagara including popular music, film exhibition, theatres, and heritage and popular memory.

funding profile

- **Social Sciences and Humanities Research Council (Co-Investigator)** **$176, 832**

Carleton
UNIVERSITY

Forging Ahead in Photonics



Carleton University Prof. Garry Tarr in the photonics lab.

IN PARTNERSHIP WITH the **National Research Council (NRC)**, Carleton University has emerged as a leader in the field of photonics research and fabrication.

As a strategic partner, Carleton will have a hand in directing the research that will be carried out at the Canadian Photonics Fabrication Centre (CPFC) being constructed by the **NRC**. This first-class facility, which also received funding from the **Ontario Innovation Trust**, is scheduled to open in summer 2004. The facility will allow faculty, researchers and students to come together from a variety of academic areas—chemistry, physics, mathematics, systems and computer engineering and electronics—to contribute their expertise to the study of light waves.

Ottawa is considered to have the largest industrial concentration of photonics activity in the country. For a time the telecommunications sector primarily focused on the transfer of massive amounts of voice and video data through fibre-optic cables, but now photonics applications are becoming more widespread. Photonics research has implications in materials processing, medicine, biotechnology, transportation, security, military and consumer products all of which are becoming increasingly reliant on laser-light application.

The CPFC will allow for simulation, design, fabrication, testing and prototyping of products and will contribute to Canada's overall emergence as a major global competitor in the market of photonics.

Currently, Carleton University has three major photonics facilities on campus: an Optical Networking Laboratory, a Microelectronics Fabrication facility and an Advanced Materials Research Laboratory. As well, the university recently signed an agreement with the University of Arizona—another leading institution in photonic development—signifying an important exchange of research, faculty and students, and underscoring Carleton's first-place ranking in international research collaboration.

funding profile

◗ National Research Council	$30 million
◗ Ontario Innovation Trust	$10 million
◗ Ontario Research and Development Challenge Fund	$3.125 million

Carleton
UNIVERSITY

Protecting the Integrity of the Internet

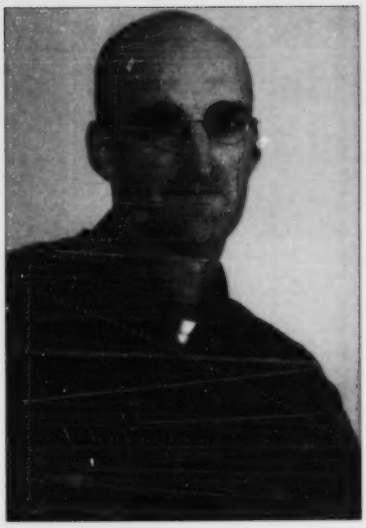
AS ONE OF Canada's leading experts in network security, Carleton University's Dr. Paul Van Oorschot has established the nation's first university program to train students and researchers to protect the integrity of the Internet.

A Professor of Computer Science, Dr. Van Oorschot holds the **Canada Research Chair** in Network and Software Security, and was a key player in the creation of the university's Digital Security Group.

From financial data to government documents, Dr. Van Oorschot's research aims to improve the integrity and privacy of information as it travels over the Internet. Dr. Van Oorschot was one of the primary developers of Public Key Infrastructure, a system of digital certificates and other registration authorities used by some of the world's largest software companies.

Dr. Van Oorschot is also involved with protecting digital content on the Internet from malicious software attacks by making reverse-engineering difficult. His work includes authentication by password controls, cryptographic mechanisms and digital signatures. Protecting applications from the rapid spread of damaging "worms" over the Internet—which can have a devastating impact on business operations—has also become increasingly important.

Dr. Van Oorschot has served as chief scientist at two of Ottawa's software security corporations, holds 14 U.S. patents, and is the co-author of the *Handbook for Applied Cryptography*. He has created extensive opportunities for graduate students, including establishing partnerships with major software corporations.



Dr. Paul Van Oorschot, **Canada Research Chair** in Network and Software Security, aims to improve the security of the Internet.

funding profile

Canada Research Chair	**$1.4 million**
Canada Foundation for Innovation	**$343,891**
Ontario Innovation Trust	**$343,891**
Private Sector Grants	**$2 million**

Carleton
UNIVERSITY

Communicating with Chemistry

DR. WAYNE WANG, Carleton's **Canada Research Chair**-Nortel Networks Chair in Emerging Organic Materials, and Director of the university's Organic Opto-Electronics Research Group, is a chemist who is world renowned for his research on organic molecules and inorganic chemical complexes.

Dr. Wang's group studies the development of organic materials for innovation, including active, passive, organic, polymeric and biological materials, as well as materials processing and device applications. Their research has had major implications in the field of high-speed telecommunications. Light-absorbing properties of certain complexes can be used to smooth out light waves that transmit data through fibre-optic cables at extremely high speeds. Using organic materials in the process of data transfer could result in significant cost-reduction for telecommunications corporations.

The group's research has led to the development of a new technology that involves using light and electricity to make credit and bank cards more secure. As well, group members are investigating organic material as an alternative to traditional silicon in the creation of computer chips for data storage.

Dr. Wang's innovative research provided a foundation for a start-up company that, in turn, received funding from the Foundry Program—Carleton's research commercialization initiative.

Currently, Dr. Wang's research is focused on exploiting certain polymer properties for night vision.

Dr. Wayne Wang is conducting research that will have major implications for the telecommunications industry.

funding profile

Dr. Wang's work has attracted funding from a wide variety of sources including:

◗ Canada Research Chair	$1.4 million
◗ Natural Sciences and Engineering Research Council	$1.3 million
◗ Canada Foundation for Innovation	$946,350
◗ Ontario Innovation Trust	$946,350
◗ Ontario Research Development Challenge Fund (in collaboration with the University of Toronto and the University of Ottawa)	$536,000
◗ Materials and Manufacturing Ontario (Ontario Centre of Excellence)	$80,000
◗ Industry	$824,000
◗ United States Government	$540,000

Carleton
UNIVERSITY

Breaking the Code of Epilepsy

EPILEPSY IS THE SECOND most common neurological disease in North America, and Carleton University's Dr. Dan McIntyre, who began research in this field in 1969, has been recognized as one of the world's leading researchers.

Dr. McIntyre, a Chancellor's Professor of Psychology at the university's Institute of Neuroscience, co-discovered the "kindling model"—the most common research tool to understand the genetic basis of epileptic seizures.

For over 15 years, Dr. McIntyre has bred 55 generations of two distinct rat populations: one group prone to epilepsy; the other resistant. Through these rats, he has discovered that temporal lobe epilepsy has a powerful genetic basis. It also helps to explain why certain people who have suffered brain trauma may be more susceptible to developing epilepsy than others.

Currently, Dr. McIntyre is looking into the relationship between certain personality traits or other tendencies and an increased vulnerability to developing epilepsy. In particular, he is examining whether impulsivity or Attention Deficit Hyper-Activity Disorder might cause a person to be more prone to a seizure disorder. He is also involved in establishing the Carleton Centre for the Behavioural, Molecular and Clinical Study of Neuronal Dysfunction.

Dr. McIntyre was recently recognized by the American Epileptic Society and the Miliken Family Foundation with a lifetime achievement award and $50,000 US cash prize.

Dr. Bruce Pappas (left), Director of the Carleton University Institute of Neuroscience, and Dr. Dan McIntyre, Chancellor's Professor of Psychology.

funding profile

- **Canadian Institutes of Health Research** $850,000
- **Natural Sciences and Engineering Research Council** $250,000

Carleton Centre for the Behavioural, Molecular and Clinical Study of Neuronal Dysfunction

- **Canada Foundation for Innovation** $665,576
- **Ontario Innovation Trust** $665,576

Carleton
UNIVERSITY

A New World Perspective

AN AUTHORITY IN the study of international affairs, rural and sustainable development, geography and environmental studies, Dr. Fraser Taylor is leading a team of researchers in the creation of the next-generation atlas.

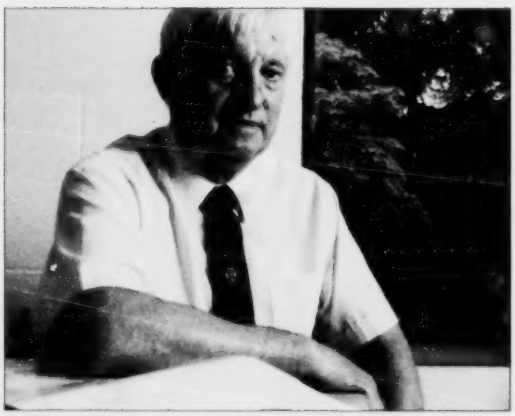
This web-based atlas will be an interactive publication that uses text, voice, music, live photography, satellite images, remote sensing, 3-D animation and statistical analysis to bring life to the study of history, geography, ecology, biology, climatology, geophysics and zoology. Currently, Canada's online national atlas attracts 150,000 new visitors each month, without any multimedia features.

Through the use of satellite imagery, the new interactive atlas will allow anyone, regardless of physical location, to virtually fly over a geographic region and view its topographical landmarks and urban areas in three dimensions, among other features.

Dr. Taylor heads Carleton University's Geomatics and Cartographic Research Centre, which contributes to both the *Cybercartographic Atlas of Antarctica* and the *National Atlas of Canada*.

Along with researchers from three other Carleton laboratories, including the Centre for Applied Cognitive Research, Dr. Fraser and his team are collaborating with Statistics Canada, Natural Resources Canada and the federal Department of Foreign Affairs and International Trade.

▼ Dr. Fraser Taylor, Professor of Geography and Environmental Studies, is leading the development of a web-based atlas.



funding profile

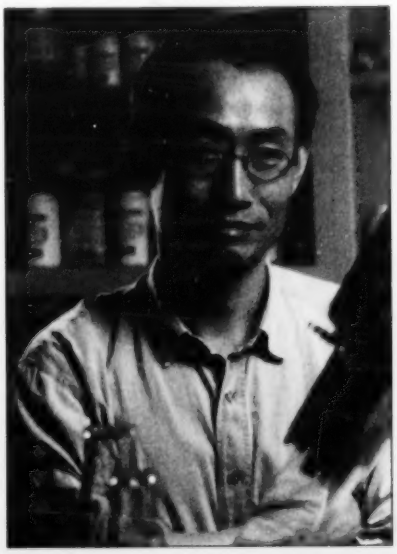
- **Social Sciences and Humanities Research Council** — **$2.6 million**

Human-Computer Interaction Institute

- **Canada Foundation for Innovation** — **$1.9 million**
- **Ontario Innovation Trust** — **$1.9 million**
- **Industry Partners**

UNIVERSITY of GUELPH

Science Takes a Calculated Step Back for the Future



▼ Prof. Jinzhong Fu is collaborating with researchers in China to preserve Tibet's biodiversity.

SOMETIMES SCIENCE'S MOST valuable genetic assets exist far from the lab. For example, the isolated Tibetan Plateau possesses many ancient groups of animals and some of the most diverse amphibian faunae in the world. Jinzhong Fu, Professor in the University of Guelph's Department of Zoology, warns that this fragile habitat is threatened by development.

"Genetic diversity is what gives a species the ability to adapt to change," explains Professor Fu. "Some consider the loss of biodiversity to be the most important problem facing us today."

This potential loss has prompted Professor Fu to reach across continents and collaborate with researchers from China to develop new methods to conserve Tibet's unique biodiversity, and to safeguard the future of this part of the world's gene pool.

Professor Fu notes that Tibet's threatened species must be assessed for biodiversity potential before they are destroyed. But first, his research team must identify those species most important to the world's biodiversity. To this end, they're employing phylogenetics, the study of evolutionary development in a species group of organisms. By mapping out phylogenetic lineages (a sort of evolutionary family tree), the researchers hope to determine the relationships between related species and correlate these relationships to their evolutionary potential.

Professor Fu and his research group will also be using molecular biology tools and techniques to explore the relationship between both related species and organisms of the same species, to develop new scientific methods of assessing evolutionary phenomena.

"Understanding these relationships may help to explain where biodiversity came from," he says.

funding profile

◗ Natural Sciences and Engineering Research Council	$146,543
◗ Canada Foundation for Innovation	$173,256
◗ Ontario Innovation Trust	$173,255
◗ Premier's Research Excellence Award	$150,000 *
◗ National Geographic Society	$18,750 (US)

*Two-thirds of each PREA is funded by the province and one-third is provided by the university.

UNIVERSITY of GUELPH

Fat: It's So Unpredictable

THE STRUCTURE AND BEHAVIOUR of fat in food constantly changes. This reality creates product inconsistencies that food manufacturers would prefer to avoid. Now, new diagnostic equipment at the University of Guelph is advancing research into the properties of fats at their crystal structure level and is helping companies create foods that are higher quality, healthier and more shelf-stable.

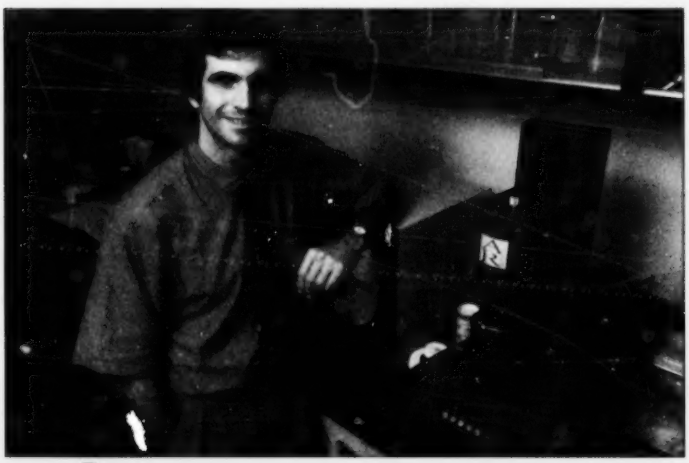
Prof. Alejandro Marangoni, Department of Food Science, is investigating the material science of fat crystallization in foods such as margarine, butter and chocolate. New laboratory equipment will give him the ability to perform more accurate and advanced analysis on the structure and mechanical behaviour of fats.

"We want to help manufacturers make products with more predictable functional properties, such as butter that's spreadable right out of the fridge," says Professor Marangoni.

The way fats behave in foods is governed by temperature variations and processing conditions, including cooling rate and mixing speed. That's because fats form tiny crystals. If these crystals melt and re-solidify in a different structure, they form larger crystals, making chocolate brittle and grainy or giving butter and margarine a sandy mouth-feel and excessive hardness.

Professor Marangoni is defining the effects of processing conditions on fat structure and properties. He's working with a volume-imaging microscope that will give him a three-dimensional view of fat crystal networks and other new equipment that will enable him to study fat's mechanical, melting and crystallization properties.

"With these new research tools, we're both solving specific industrial problems and answering fundamental scientific questions," he says.



Prof. Alejandro Marangoni is using new diagnostic equipment to study the properties of fat in food.

funding profile

Canada Research Chair	$500,000
Natural Sciences and Engineering Research Council	$352,000
Canada Foundation for Innovation	$220,000
Ontario Innovation Trust	$145,000
Ontario Ministry of Agriculture and Food	$200,000
Premier's Research Excellence Award	$150,000 *

*Two-thirds of each PREA is funded by the province and one-third is provided by the university.

UNIVERSITY of GUELPH

Neuron Connection Reveals Cancer Virus Information

THE FELINE LEUKEMIA VIRUS (FeLV), which causes leukemia and other diseases in cats, has also been known to attack nerve tissue in the spinal cord, causing lack of co-ordination, paralysis and death. Now, a University of Guelph researcher has made a startling discovery about the virus's targets—one that may have application to viral spinal cord infections in humans.

Prof. Dorothee Bienzle, Department of Pathobiology, has found a link between FeLV infection and neurological disorders in cats. She's discovered that the virus infects neurons—which was unknown until now.

FeLV belongs to the family known as retroviruses that use an enzyme called reverse transcriptase to insert their own genetic code into the host cell DNA and often cause tumours in the host. The virus was thought to only target cells that can replicate, something neurons can't do.

But Professor Bienzle has shown that FeLV does attack neurons. She confirmed this link with the help of laser microdissection, which allows researchers to isolate and examine individual brain cells for viral components with high accuracy.

Professor Bienzle's research could improve disease control practices and provide insight into human neurological diseases. Next, she hopes to determine the mechanism by which FeLV infections lead to neurological diseases.

▼ Prof. Dorothee Bienzle is studying the feline leukemia virus and its potential links to viral spinal cord infections in humans.

funding profile

Natural Sciences and Engineering Research Council	$104,000
Canada Foundation for Innovation	$399,976
Ontario Innovation Trust	$399,976
Premier's Research Excellence Award	$149,946 *

*Two-thirds of each PREA is funded by the province and one-third is provided by the university.

UNIVERSITY of GUELPH

A New Window into the Universe

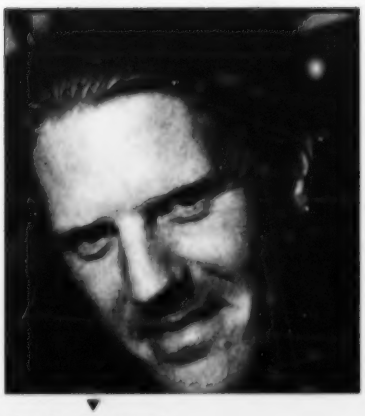
A NEW "EYE" developed at the University of Guelph may allow physicists to finally solve one of the oldest and most perplexing questions: how were the elements in the universe created?

The eye—a high-resolution, position-sensitive gamma-ray spectrometer—is used to detect high-energy light emitted by the atomic nucleus. With higher sensitivity and more sophisticated electronics than any other detector of its kind, the gamma-ray spectrometer will be able to "see" into an atom's core, shedding light on the nature of nuclear matter and some fundamental questions about the physical universe, such as how the elements were formed in astrophysical events of the past.

Prof. Carl Svensson in the Department of Physics is using this detector at the Isotope Separator and Accelerator (ISAC) facility that's part of Canada's National Laboratory for Particle and Nuclear Physics. It's now the most advanced facility for rare isotope research in the world. He and his colleagues are studying nuclear reaction processes—similar to those that take place in the sun—and comparing their results to current knowledge about astrophysics.

Professor Svensson says the nuclear reactions that take place during many of these events have never been measured before, because the reacting nuclei were too short-lived for the laboratory. But thanks to ISAC and the new gamma-ray detector, he can directly study the nuclear reactions believed to be responsible for the synthesis of the chemical elements.

"This detector is unique," says Professor Svensson. "When you combine it with the ISAC facility, which produces the most intense ion beams available in the world, there are new opportunities to explore a wide range of fundamental questions."



Prof. Carl Svensson is studying nuclear reaction processes.

funding profile

Natural Sciences and Engineering Research Council	$757,990
TRIUMF (TRI-University Meson Facility)	$100,000
Canada Foundation for Innovation	$320,000
Ontario Innovation Trust	$320,000
Premier's Research Excellence Award	$150,000 *
Research Corporation's Research Innovation Award	$52,920
University of Guelph	$60,000

*Two-thirds of each PREA is funded by the province and one-third is provided by the university.

UNIVERSITY of GUELPH

A Glass of Wine, an Ounce of Prevention

Prof. Gopi Paliyath, Prof. Kelly Meckling and graduate student Fatima Hakimuddin are examining the cancer-fighting abilities of red wine.

BY COMBINING KNOWLEDGE and expertise in animal production systems, plant biotechnology and the fundamentals of molecular biology, the University of Guelph's Food System Biotechnology Centre (FSBC), which received $6.2 million from the **Ontario Research and Development Challenge Fund**, is a recipe for success. Born out of a three-way partnership between the university, governments and industry partners, the FSBC has synergized the efforts of researchers working in related areas, to form collaborations within the university and take research into innovative new directions.

With projects in areas such as environment-friendly agricultural practices, novel food products and animal and human health, the FSBC supports foundational, "building-block" research, taking multidisciplinary ideas from concept to outcome.

"The FSBC is focusing on agricultural producer and industry benefits," says Alan Wildeman, Vice-President (Research). "But the technologies will reach a far wider number of people across Ontario."

There's proof that red wine may help prevent breast cancer, say University of Guelph researchers. By comparing the effects of wine on healthy human cells and cancer cells, Prof. Gopi Paliyath, Department of Plant Agriculture, Prof. Kelly Meckling, Department of Human Biology and Nutritional Sciences, and graduate student Fatima Hakimuddin have found that flavonoid components in the wine kill the cancer cells while leaving the normal cells intact.

Red wine is rich in flavonoids—the nutraceutical components known for their antioxidant properties—containing between one and four grams per litre (compared with less than 0.25 grams per litre in white wine). Previously linked to lower risks of coronary heart disease, flavonoids also appear to fight cancer by affecting the cell division process, which is highly regulated in normal cells but goes haywire in sick cells.

Research points to the possibility that flavonoids can restore overactive "messenger systems" in the cells to normal levels and stop the uncontrolled growth of tumour cells. This can work to prevent the development of breast cancer—and potentially similar types of cancer—because the selective action of flavonoids leaves normal healthy cells unharmed, while diseased cells are stopped in their tracks from replicating.

Next, the researchers want to try increasing the cancer-fighting ability of wine by using grapes with inherently higher levels of flavonoids.

funding profile

Natural Sciences and Engineering Research Council	$95,570
Agriculture and Agri-Food Canada	$104,000
Ontario Ministry of Agriculture and Food	$150,000
Food System Biotechnology Centre	$270,000
Breast Cancer Society of Canada	$60,000
Foragen Technology Ventures	$414,450
H. J. Heinz Company of Canada Ltd.	$75,000
Potash and Phosphate Institute, CanAdapt	$197,928

Lakehead
UNIVERSITY

State of Amphibians an Indicator of Ecosystem Health

FOCUSING ON AMPHIBIAN ecology, Lakehead University's Dr. Stephen Hecnar is unravelling the patterns of nature to understand how natural communities are organized, and to help conserve biodiversity and the integrity of ecosystems.

Dr. Hecnar, who teaches in the Department of Biology, is providing valuable insights into amphibian ecology at a critical time when there are concerns of a global decline of amphibian populations.

"This task is urgent because of mounting losses of species due to habitat degradation and destruction," Dr. Hecnar says. "Humans have fragmented many habitats resulting in area loss and reduced distribution of species. This artificial patchiness impedes movement of individuals among populations and increases the chances of species loss. Ultimately, fragmentation of formerly continuous habitats results in loss of biodiversity."

Dr. Hecnar's research explores how landscape features and habitat alteration affect movements, extinction and diversity of amphibians. Amphibians play a vital role in nature because they are both predator and prey in many food webs, and they use both land and water habitats.

Amphibians are also sensitive to environmental changes because of their biology and dependence on water. They make good indicators of ecosystem health by acting as "canaries in coalmines."

Through his research, Dr. Hecnar has determined that amphibian communities are highly dynamic systems that are strongly influenced by both local and regional factors.

"Amphibian communities differ regionally across Ontario, each one reflecting the influence of natural factors and bearing the legacy of past human land use practices," he says. "The species that occur in a given community, including their commonness or rarity, are determined by the interaction of their biological characteristics (such as dispersal capabilities, resource requirements and vulnerability to predation or pollution) with physical factors (such as climate, habitat structure and the nature of the landscape). Alteration of environments resulting from either natural or human processes ultimately alter amphibian communities."

Through a **Premier's Research Excellence Award**, Dr. Hecnar has trained a postdoctoral fellow, four graduate students, four undergraduate assistants and one research technician. Though early in the publication phase of his research, he has already published eight journal papers, two technical reports and 13 conference presentations.

▼ Dr. Stephen Hecnar studies amphibians because they are good indicators of ecosystem health.

funding profile

◗ Natural Sciences and Engineering Research Council (Discovery)	$66,000
◗ Parks Canada	$53,570
◗ Premier's Research Excellence Award	$150,000 *

*Two-thirds of each PREA is funded by the province and one-third is provided by the university.

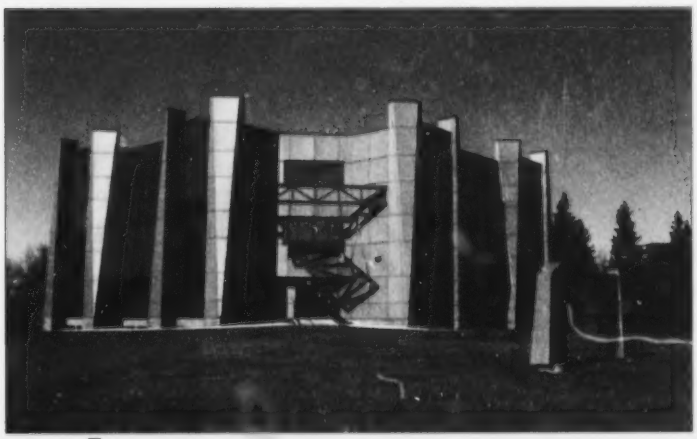
Lakehead
UNIVERSITY

Lakehead's Paleo-DNA Laboratory

ESTABLISHED IN 1996, the Lakehead University Paleo-DNA Laboratory is among the pioneers in the application of modern molecular genetic techniques and technologies to the study of ancient mitochondrial DNA in human, plant and animal remains.

In 2001, the laboratory constructed a new facility that incorporates a combination of positive and negative pressure-controlled access clean rooms and a dedicated ventilation system that enables a maximum of contamination controls.

The applications of modern genetic techniques, optimized and applied to ancient human, animal, plant and pathogenic material, are significant for archaeological interpretation of population movements, ecology, disease, host pathogen relationships, the development of genetic resistance and many other novel investigations.



The Paleo-DNA Laboratory is housed within the Northern Ontario Technology Centre at Lakehead.

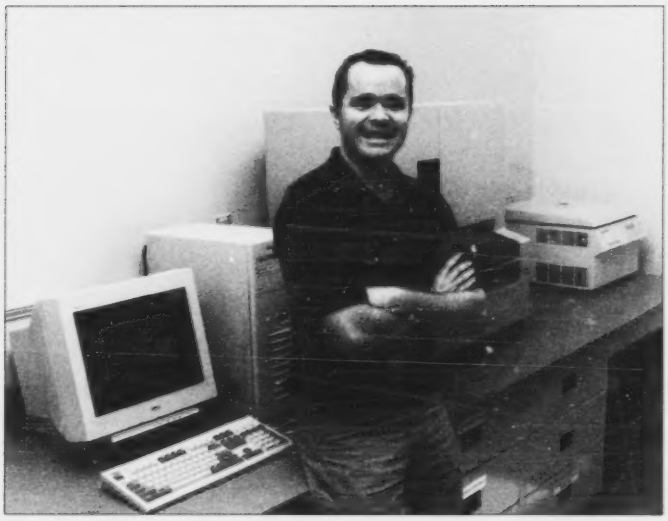
This past year, the Paleo-DNA Laboratory attracted international attention with its efforts in identifying the "Unknown Child" victim of the 1912 Titanic disaster using DNA analysis. The project, under the direction of Principal Investigator Ryan Parr, was the subject of a PBS documentary entitled *Titanic's Ghosts*.

The Paleo-DNA Laboratory has worked on projects for the United Nations involving DNA identification of war crime victims buried in mass grave sites. It has also played a key role in attracting innovative professionals such as Laboratory Director Carney Matheson, formerly of the Institute for Molecular Biosciences, University of Queensland, Australia.

Since coming to Lakehead, Dr. Matheson has undertaken the recovery of DNA from the "Weerdinge Couple"—a rare 1904 discovery of two bog bodies found together in Weerdinge, Netherlands. Because of their apparent loving embrace, it was originally thought they were a man and a woman. Further investigations of these late Iron Age or Roman-era bodies revealed that they were, in fact, two males. In a 1937 speech, Heinrich Himmler, head of the Nazi SS, used this discovery as an example of how northwestern Europeans would execute homosexuals throughout the ages. However, after the war, the most popular belief was that the bog people were sacrificed to some god.

Scientists have pondered the relationship of the bog people in hopes of giving the Weerdinge Couple an identity. So far, studies have shown that these two indi-

(continued)



Dr. Carney Matheson left the University of Queensland in Australia to work at Lakehead's Paleo-DNA Laboratory.

viduals were not maternally related; however, further investigations will discover if they were paternally related.

While bog bodies have, on occasion, been remarkably preserved, the recovery of DNA from these bodies had always eluded researchers due to molecular and DNA degradation caused by the acidic conditions within the bog. Dr. Matheson had to overcome these problems to analyze the DNA from the bog body material.

In addition to his work with the Weerdinge Couple, Dr. Matheson is investigating the genetic evolution and spread of disease to generate models that will enable researchers to better understand present-day disease.

funding profile

Canada Foundation for Innovation	$418,000
Ontario Innovation Trust	$158,000
Ontario Research and Development Challenge Fund	$260,000
Northern Ontario Heritage Fund Corporation	$1.2 million

Lakehead
UNIVERSITY

Helping People Maintain Independence and Quality of Life

DR. MICHEL BEDARD, Lakehead University's **Canada Research Chair** in Aging and Health, is committed to helping people maintain independence and quality of life as they age—issues that will impact us all eventually. His research intends to identify the pressures exerted on society and individuals by the aging process and to develop strategies to minimize the negative impact of these pressures. Dr. Bédard focuses on two critical areas: driving and family caregiving.

"Driving as a means to maintaining an independent, active and rewarding lifestyle is an essential component of successful aging," says Dr. Bédard. "However, driving safety issues concerning older adults have been ignored because young drivers account for the large proportion of severe crashes, although recent data show that older adults will be involved in increasing numbers of crashes. Unfortunately, we have little information regarding the skills supporting safe driving in older drivers and the consequences of driving cessation in older adults. The goal of my research is to find answers to these questions and ultimately promote the quality of life and independence of older adults."

Dr. Michel Bédard's research aims to help older adults drive safely.

Dr. Bédard's current research projects include the examination of cognitive processes supporting safe driving and the impact of driving cessation (**Premier's Research Excellence Award**); and the development of retraining programs for older drivers (Dewar Award and AUTO21 **Networks of Centres of Excellence**). The **Canada Foundation for Innovation** has provided funding for a driving simulator that will help to achieve some of the research goals set out by the team.

Together, these projects form the basis of an ambitious program to better support older adults as drivers and to support their transportation needs as they make the transition from drivers to non-drivers.

Initial results suggest that older drivers, regardless of their age, can improve their driving skills. Future research will examine strategies to maximize driving safety.

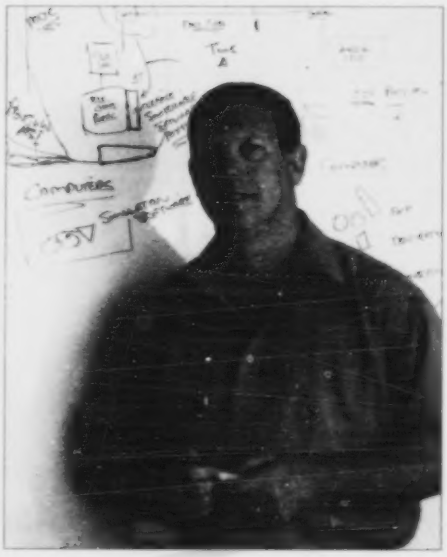
funding profile

Canada Research Chair	$500,000
AUTO21 (Networks of Centres of Excellence)	$76,000
Canada Foundation for Innovation	$75,000
Premier's Research Excellence Award	$150,000 *
Thunder Bay Foundation—R. K. Dewar Research Award	$25,000

*Two-thirds of each PREA is funded by the province and one-third is provided by the university.

Laurentian University / Université Laurentienne

Bringing Mining into the 21st Century



Dr. Greg Baiden is bringing technological innovation to Canada's mining industry.

DR. GREG BAIDEN, Director of Laurentian University's School of Engineering and **Canada Research Chair** in Robotics and Mine Automation, wants to bring the technology of the future to Canada's mining sector.

The former head of mines research at Inco Limited, Dr. Baiden has dedicated his career to building and managing research initiatives in mining automation and has developed the world's first tele-remotely operated mining machines. He is considered Canada's foremost authority in mining automation.

Dr. Baiden, who maintains strong links with the mining sector in Canada and abroad, also led a team of engineers, academics and scientists in conceptualizing, designing and implementing future mining techniques. These efforts focused on mining methods and rock mechanics, automation and robotics, and process planning and simulation.

In his ongoing research, Dr. Baiden draws on his industrial expertise to focus on fundamental and applied research to further develop concepts of tele-mining for Canada's mining industry. His work centres primarily on creating tele-operated robots to mine and process ore, and developing mineral economics and operations strategies for these technologies. Over time, Dr. Baiden will broaden the scope of this research to include space mining, environmental clean-up and underwater applications.

Dr. Baiden's latest efforts will provide highly skilled human resources and advanced technological systems needed to run the mines of the future. His solutions will ensure a safe, profitable and growing industry in mineral production for Canada, and lay the groundwork for a vibrant technology- and knowledge-based mining sector that will reinforce Canada's international leadership in this emerging field.

funding profile

Canada Research Chair	$1.4 million
Natural Sciences and Engineering Research Council	$76,000
Canada Foundation for Innovation	$125,000
Ontario Innovation Trust	$125,000
Communications and Information Technology Ontario (Ontario Centre of Excellence)	$200,000

Laurentian University / Université Laurentienne

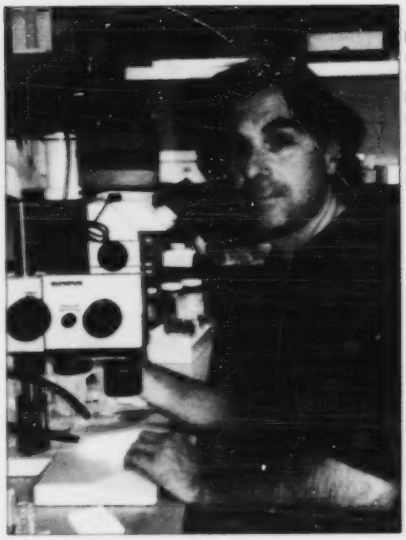
On the Trail of the Water Beetles

OVER THE LAST 12 years, Dr. Yves Alarie, a Biology Professor at Laurentian University, has earned a far-reaching reputation for his research on the ecology and evolution of water beetles—part of the largest order of insects on the planet.

While most classifications of water beetles are based on adult features, Dr. Alarie seeks to determine the genealogy of water beetles by studying their growth from the larval to the adult stage. Research into insect larval morphology is needed because the larval stage is the most important phase of the insect's life and the stage at which most problems with insects occur. Adults exist mainly to reproduce the species and die once that is done.

In 12 years, Dr. Alarie has described over 150 species of insects from all around the world. Together with Dr. D.J. (David) Larson from Memorial University and Dr. R.E. (Rob) Roughley from the University of Manitoba, he has co-written *Predaceous Diving Beetles (Coleoptera: Dytiscidae) of the Nearctic Region*, a tool for identification of most of the North American species of this important group of freshwater insects.

As a result of his scientific research, Dr. Alarie was presented with the 2003-2004 Laurentian University Research Excellence Award.



Dr. Yves Alarie's research into insect systematics includes both taxonomy (naming species) and phylogeny (establishing common genealogical links among species).

funding profile

- **Natural Sciences and Engineering Research Council** — **$88,000**

Laurentian University · Université Laurentienne

Giving Skills and a Voice to Young Girls and Women

CAROL KAUPPI, a Social Work Professor at Laurentian University, focuses her research on girls and women, poverty, homelessness and services for children and families in northern communities. Her range of community-based research initiatives with young girls has earned her a wide reputation.

Cybermoms, one of Dr. Kauppi's projects, focuses on teenage pregnancy and teenage parenthood. It is a demonstration and research program that offers support to pregnant teens and young mothers by giving them access to free computers and web technologies. With their free equipment and Internet access, participants became part of an online peer support group, a "cyberfamily." And through this mutual aid network, members of a disadvantaged group—pregnant teens and young mothers—develop valuable practical skills.

GirlSpoken: Creative Voices for Change is another research initiative led by Dr. Kauppi that combines programming, research and the production of resource materials for girls and young women. This province-wide study offers teen girls the chance to share their experiences, knowledge and ideas.

Dr. Kauppi believes that positive change can be achieved through projects that engage young women in a discussion about who they are and how they want to redefine their place in the community. Projects such as GirlSpoken provide young women with skills and strategies to cope with the challenges and barriers they face during adolescence.

Dr. Kauppi also works closely with the Social Planning Council of Sudbury. In the past years, she has received funding for various projects to study poverty and homelessness.

Dr. Carol Kauppi's research focus is on supportive research initiatives for girls and women.

funding profile

Social Sciences and Humanities Research Council	$20,000
Trillium Foundation (Ontario)	$155,174

Laurentian University · Université Laurentienne

Supporting Rural Health Through Research

DR. RAYMOND PONG, the Research Director of the Centre for Rural and Northern Health Research and a Professor at Laurentian University, is spearheading a program of research designed to address a host of rural health issues.

Rural health is a complex phenomenon that has never been studied in a systematic manner. Dr. Pong's Centre is taking advantage of Laurentian's Northern Ontario location to gain a better understanding of rural health issues in this vast "laboratory."

Working closely with other researchers, Dr. Pong, a sociologist by training, is conducting a series of studies that span a broad spectrum. He is investigating the health status of rural Canadians and the determinants of rural health. He has also done a series of interrelated studies on tele-health as a means to bring health services to remote areas, and examined continuity of care, particularly in a rural setting, as it relates to elderly patients discharged from hospitals and children with severe mental health problems.

Shortages of health care practitioners in rural areas are a perennial concern, and, consequently, are the focus of a number of Dr. Pong's studies, including one that examines the role of rural medical education in strengthening the rural medical workforce. His other studies deal with the education and employment of nurse practitioners and a synthesis of rural health workforce policies and strategies.

The findings from these and other studies by Dr. Pong are helping to inform and shape rural health policies.

Dr. Raymond Pong is conducting a series of investigations into the complex field of rural health issues.

funding profile

Canadian Institutes of Health Research	$95,000
Canadian Health Services Research Foundation and Ontario Ministry of Health and Long-Term Care	$97,000
	$177,000
Ontario Ministry of Health and Long-Term Care	$180,000
The Richard Ivey Foundation	$253,000
	$97,000

Laurentian University · Université Laurentienne

Unlocking the Structure of Molecules

DR. GUSTAVO ARTECA, Chemistry and Biochemistry Professor at Laurentian University and **Canada Research Chair** in Biophysical Computational Chemistry, is developing mathematical theory, computational tools and programs for molecular modelling. His findings are then applied to study biomolecules.

A world leader in his field, Dr. Arteca looks at the structure and properties of small and large chain molecules. He investigates things such as the shape of a molecule, its solubility, its ability to recognize and bond to other compounds and the strength of this bond. Dr. Arteca's research, which uses computer simulation, will eventually help us to understand and predict the behaviour of molecules.

This knowledge has biological and pharmaceutical applications because it will reveal if a molecule will function as a drug, and how it will be absorbed by the body.

Part of Dr. Arteca's research efforts involves the development of computer programs to calculate the shape and stability of a chemical polymer. The goal is to create a three-dimensional simulation of a long chain molecule. With that, compounds can be manipulated and studied with the click of a mouse, rapidly and repeatedly, bypassing the difficult process of manipulating a single polymer molecule in a laboratory. This advantage is particularly important in understanding the processes by which proteins can change and then recover their functional shapes within cells.

Much of the funding that Dr. Arteca receives goes toward working with students in his laboratory, including research assistants, a postdoctoral research fellow, and undergraduate and graduate students.

▼ Dr. Gustavo Arteca was awarded the Laurentian University Research Excellence Award in 1997.

funding profile

▸ Canada Research Chair	$1.4 million
▸ Natural Sciences and Engineering Research Council	$228,000

McMaster University

Inspiring Innovation and Discovery

Shining New Light on Genetic Research

▼ Biochemist Yingfu Li is holding test tubes containing a high concentration of fluorescent DNA probes.

IT WASN'T EXACTLY a "Eureka!" moment but, while sitting on a plane bound for a Genome Canada meeting in Calgary, biochemist Yingfu Li realized that his lab might have built a better mousetrap.

Dr. Li, a **Canada Research Chair** in Directed Evolution of Nucleic Acids, was referring to the new kind of molecular beacon he had developed with Razvan Nutiu, one of his PhD students.

Molecular beacons are hairpin-like fluorescent DNA probes—little lighthouses on a molecular scale—that actually light up when they detect a specific DNA sequence. Molecular beacons can be used to detect mutations in DNA, such as those that cause disease, and can also be used to find new drugs to target disease or to develop a gene therapy.

"They are beautiful gene detection tools," acknowledges Razvan, " but they are very, very expensive." At a cost of $400 US per unit, molecular beacons are not practical when hundreds, or even thousands, of different DNA sequences need to be detected simultaneously or separately.

Dr. Li's new type of molecular beacon will cost between $40 to $50 Cdn per unit, bringing significant savings to genetic research using molecular beacons.

Dr. Li and his team of more than 30 undergraduate, graduate and postgraduate students are testing and refining the use of molecular beacons as an important tool in biomedical applications—research that is providing benefits in terms of disease control and drug screening. They are also creating and studying DNA with interesting properties, such as those with the ability to disable disease-causing proteins.

funding profile

◗ Canada Research Chair	$500,000
◗ Natural Sciences and Engineering Research Council	
—Collaborative Research and Development	$1,851,870
—Discovery	$140,000
—IMP6	$15,000
◗ Canadian Institutes of Health Research	
—Operating Grants	$760,374
—Proof of Principle Award	$99,260
◗ Premier's Research Excellence Award	$150,000 *
◗ MDS Sciex	$231,720

*Two-thirds of each PREA is funded by the province and one-third is provided by the university.

McMaster University

Inspiring Innovation and Discovery

"Vulcan" Puts Canada on the World Stage

McMASTER'S NEUTRON BEAMLINE is affectionately referred to as Vulcan, named after the god of fire and metalworking. And according to McMaster University physicist Bruce Gaulin, the name is a perfect fit since Vulcan will be used to study materials engineered from metal.

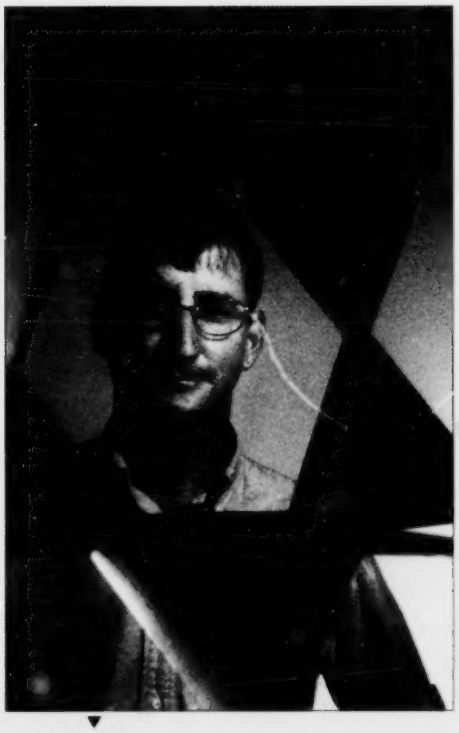
Dr. Gaulin received funding from the **Canada Foundation for Innovation (CFI)** to build and locate the beamline instrument at Oak Ridge National Laboratory in Tennessee. The McMaster beamline—the only Canadian instrument at the scientific facility—will be one of 24 state-of-the-art research instruments housed at the $1.4 billion Spallation Neutron Source, scheduled to open in Oak Ridge in 2006. The facility is headed by McMaster physics alumnus Thom Mason.

"We will be there as real partners in discovery, in the creation of knowledge relevant to a variety of materials--new plastics and ceramics, composite materials, biological materials, magnets and superconductors and engineering components intended for products that will improve our quality of life," says Dr. Gaulin.

The neutron beamline allows scientists a window into the materials at the atomic and molecular level. Researchers will be able to look at the material on a microscopic level, to see how it's arranged and structured and how the solid holds itself together. Dr. Gaulin's group will study manufactured components, such as materials used in turbine jet blades, to understand why they fail and how they can be made stronger and more reliable—clearly, a matter of public safety.

Dr. Gaulin, who currently supervises four graduate students and two postdoctoral fellows, says the importance of the **CFI** funding can't be overstated.

"It's not something we could do at a local or even a national level. It let us get in the game. Without it, we wouldn't even be at the starting block," he says.



Dr. Bruce Gaulin heads up Vulcan—McMaster's neutron beamline—at the Oak Ridge National Laboratory in Tennessee.

funding profile

Canada Foundation for Innovation (International Access Fund)	$15 million
Natural Sciences and Engineering Research Council (Discovery)	$390,000
Joint with University of Toronto—Materials and Manufacturing Ontario (Ontario Centre of Excellence)	$400,000
Canadian Institute for Advanced Research (Quantum Materials Program)	$10,000

McMaster University

Inspiring Innovation and Discovery

Taking a Quantum Leap in New Materials

McMASTER PHYSICIST Catherine Kallin was first drawn to science through the magic of mathematics. She remembers "being inspired by the beauty, elegance and power of pure mathematics, and the strong desire to apply this power—at a deep, fundamental level—to understanding how the world works." And now she's doing just that.

Dr. Kallin, who currently supervises four master's students and two PhD students, is studying condensed matter physics and quantum materials, including unconventional superconductors and novel magnetic materials. These 21st century materials exhibit properties and behaviours different from conventional metals, semiconductors, magnets and superconductors.

A **Canada Research Chair** in Quantum Materials Theory, Dr. Kallin is contributing to our knowledge of new phenomena in quantum materials. These materials will ultimately find uses in new devices, including applications in quantum computers, and in magnetic resonance imaging and satellite communications. Dr. Kallin also believes that studying quantum materials will change our thinking about the nature of matter and will yield new ideas about elementary particle physics and the early universe.

Her research and its subsequent applications will lead to our understanding of novel states of matter that, ultimately, may change the way we live and the way we think.

▼ Dr. Catherine Kallin's research explores the electronic properties of novel materials.

funding profile

Canada Research Chair	$1.4 million
Natural Sciences and Engineering Research Council (Discovery)	$360,000
Canada Foundation for Innovation	$117,732
Ontario Innovation Trust	$117,731
SHARC-NET Fellowship	$70,040
Materials and Manufacturing Ontario (Ontario Centre of Excellence)	$70,050
Canadian Institute for Advanced Research	$75,000
	$125,000

McMaster University

Inspiring Innovation and Discovery

Moving Beyond the Visible Universe

WHILE EVERYONE KNOWS "It's Slinky®," not everyone knows that in Dr. Christine Wilson's hands the popular spring toy is a visual prop that illustrates how magnetic fields wind around a filament where a star formation occurs.

An astrophysicist, Dr. Wilson is best known internationally for her work on star formation in nearby galaxies, using a variety of optical and radio telescopes including the James Clerk Maxwell Telescope located in Hawaii.

"Much of the astronomical research of the next decade is expected to focus on understanding the origins of planets, stars, galaxies and even the universe itself. Millimetre-wave radio astronomy is a crucial tool in this quest for origins, because it allows us to probe into the cold, dark regions of space where many of these formation processes occur," says Dr. Wilson.

Her research on how stars, planets and galaxies are formed will be greatly enhanced by the $7.9 million investment from the **Canada Foundation for Innovation** toward the Atacama Large Millimetre Array (ALMA) project in Chile. This $550 million US international project will be the highest altitude, full-time ground observatory in the world. Dr. Wilson will be Canada's project scientist at this ambitious initiative—considered to be the most important development in radio astronomy this decade.

Dr. Wilson is also one of six Canadian-project scientists using data from the astronomical satellite Odin to study water and oxygen in the interstellar medium. A **Natural Sciences and Engineering Research Council** grant supports this astronomy/aeronomy research mission, which is led by Sweden with Canada, France and Finland as partners.

Astrophysicist Christine Wilson is an international expert in star formation.

funding profile

- **Natural Sciences and Engineering Research Council**
  - **—Discovery** **$240,000**
  - **—Collaborative Special Projects** **$867,000**
- **Premier's Research Excellence Award** **$150,000** *

*Two-thirds of each PREA is funded by the province and one-third is provided by the university.

McMaster University

Inspiring Innovation and Discovery

Using Scarce Resources—Government Funding and Policy Decisions Affect Us All

WE ARE ALL AFFECTED by how the government allocates funds for education, research and social welfare. In fact, government-funding decisions in these areas have a profound impact on our lives—they correct market imperfections, promote more equitable resource distribution and foster economic development. And yet in Canada there hasn't been much research into their impact.

Dr. Abigail Payne, Associate Professor of Economics, is changing that. As **Canada Research Chair** in Public Economics, she's studying government expenditures and policy and the effects of change in government policy on individual households and other entities.

Having arrived at McMaster University from the United States in 2002 , Dr. Payne expects to translate many of her research subjects and results to the Canadian context.

Her research will focus on a number of questions including:

- Does promoting choice in schooling options improve student performance?
- How does the centralization of financing kindergarten to Grade 12 education at the provincial level affect student performance?
- Does the amalgamation of school boards affect the performance of students?
- What factors contribute to a successful transition from high school to university?
- How do university policies towards scholarship and grants affect a student's decision to attend university?
- How does government funding of charitable and non-profit organizations affect their operation and their fundraising success in attracting private donations?
- Given reduced public funding at all levels in Canada, what policies should governments pursue to ensure that non-profit organizations continue to support needy households?

Dr. Abigail Payne is investigating the impact of government funding on education and social welfare.

funding profile

Canada Research Chair	$500,000
Social Sciences and Humanities Research Council (Canadian Education Statistics Council—Education Research Initiative/BC Ministry of Education)	$91,960
Canada Foundation for Innovation	$571,532
Ontario Innovation Trust	$571,533

NIPISSING UNIVERSITY

The Consequences of Heavy Metal on Fish

Dr. Greg Pyle, investigating the effects of metal pollution on aquatic animals, takes a blood sample from a yellow perch. Graduate student Charles Gauthier (Laurentian University) looks on.

BIOLOGY PROFESSOR GREG PYLE examines how metal pollution affects fish and aquatic invertebrates.

Aquatic animals communicate by secreting chemical signals to convey a message or to warn of a predator. When a metal pollutant is introduced into the water, it blocks an animal's ability to read these messages, causing it to be more susceptible to predators.

Through his research, Dr. Pyle is attempting to confirm that metal toxicity, though not necessarily killing fish, is eliminating their food sources through the impairment of their chemical communication systems. Ultimately, fish will be left with nothing to eat if invertebrates cease to communicate and perish.

funding profile

- **Natural Sciences and Engineering Research Council** — **$52,000**
- **Metals in the Environment Research Network** — **$73,000**
- **Contract for Living Legacy Trust, Ontario Ministry of Natural Resources and the Temagami Stewardship Council (with Dr. Tony Parkes)** — **$25,000 (cash and in-kind)**

NIPISSING UNIVERSITY

Victorian Visual Culture and Illustrated Poems

VICTORIAN POETRY AND ILLUSTRATION is the title of English Professor Lorraine Janzen Kooistra's **Social Sciences and Humanities Research Council** project. A combination of literary criticism, publishing history and textual theory, this book-length study seeks to establish new ground for understanding poetic production, distribution and reception in the Victorian period. Dr. Janzen Kooistra's work contextualizes the illustrated Annuals of the 1830s, Gift Books of the 1860s, and Belles Lettres of the 1890s, within the visual and material culture(s) that developed between 1830 and 1900. This research is closely related to, and will build on, her recent book, *Christina Rossetti and Illustration: a Publishing History*, but will have a much broader scope.

In collaboration with Dr. Andrew Stauffer of Boston University, Dr. Janzen Kooistra is also examining the archives of F.S. Elliot, an antiquarian book collector and bookseller who published controversial poetry circa 1870.

Dr. Janzen Kooistra published her first book of poetry, *Learning to See in the Dark*, in 2003.

Dr. Lorraine Janzen Kooistra studies Victorian poetry and illustration in a cultural context.

funding profile

- **Social Sciences and Humanities Research Council** — **$38,836**
- **Nipissing University Research Achievement Award** — **$5,000**

NIPISSING UNIVERSITY

Going Beyond the Third Dimension

Topologist Vesko Valov works beyond the third dimension.

MATHEMATICS AND COMPUTER SCIENCE

Professor Vesko Valov is researching dimension theory based on topological ideas.

Dimension theory examines the space in which we live and develops a better understanding of the dimensions that we cannot see. Theoretically, there are many more dimensions than the three in which we live. Research in mathematics is based on current knowledge, but intuition is also important. Very often, to obtain new results researchers should be able first to find the right formulation and then to prove this formulation is correct or incorrect. That's why Dr. Valov's research involves his intuition combined with developing new ideas and techniques for proofs

The applications of his work are far reaching, from a new understanding of the space around us to a better grasp on outer space and space travel.

funding profile

- **Natural Sciences and Engineering Research Council** **$34,000**

NIPISSING UNIVERSITY

Genes in Space: How Space Flight Affects Aging and Genetics

Dr. Tony Parkes' research involves the neurobiology of aging and how oxygen free radicals affect this process. Free radicals are unstable molecules that can react quickly with other atoms and molecules and cause damage to living tissues.

Dr. Parkes has found that the enzymes which metabolize free radicals in fruit flies perform the critical function of protecting the motor neuron—a lifespan-limiting tissue.

Dr. Parkes is working with the Canadian Space Agency, NASA and the International Space Station to develop an insect habitat to monitor how the environment encountered during space flight affects the genetics and physiology of fruit flies. The project promises to reveal the role of gravity and radiation in many aspects of biology including development, behaviour and aging. It also has implications toward the possibilities of long-term space flight missions and eventual human colonization of space. The insect habitat is scheduled for installation on the International Space Station in 2006.

Dr. Tony Parkes investigates how space travel affects genetics.

funding profile

◗ Canadian Space Agency	$50,000
◗ Contract for Living Legacy Trust, Ontario Ministry of Natural Resources and the Temagami Stewardship Council (with Dr. Greg Pyle)	$25,000 (cash and in-kind)

Université d' Ottawa
University of Ottawa

Looking More Closely into the Canadian Mirror

CANADA'S CENSUS HAS been undertaken each decade since Confederation, adding greatly to our understanding of Canadian society. During the first half of the 20th century, however, this process was a daunting task. Census-takers posed dozens of questions to every individual in Canada and recorded the results through a labourious process of assembling and collating handwritten responses. No less demanding was the statistical analysis of these results, restricted by the manual methods that predated the widespread use of computer technology. Yet if this original data could be converted into a format compatible with today's technology, contemporary researchers could extract fresh insights about the making of modern Canada.

In 2002, the Canadian Century Research Infrastructure (CCRI) project was launched to undertake this challenge. The CCRI is one of Canada's largest social science research initiatives, enlisting dozens of participants from seven university centres including Victoria, Ottawa, Toronto, York, Trois-Rivieres, Laval and Memorial.

Using state-of-the-art information technologies, researchers are capturing, storing and examining the data collected in each decennial census from 1911 to 1951. The resulting database will join existing databases of census figures from 1871 to 1901 and from 1961 to 2001. By closing the gap between these periods, the CCRI will make it possible to create a dynamic and comprehensive statistical picture of Canadian society since Confederation.

Dr. Chad Gaffield is leading the project which is based at the University of Ottawa's Institute of Canadian Studies. He points to remarkable research results that have already emerged from recent studies of historical Canadian census data. For example, single-parent homes—widely regarded as a more recent phenomena—were discovered to be relatively common a century ago. Moreover, many of these homes were led by women, who often served as parent and sole breadwinner.

"This research infrastructure will not only produce knowledge, but will forge new directions in conducting research, in knowledge transfer and in the education of a new generation of researchers."

Dr. Chad Gaffield is leading the Canadian Century Research Infrastructure project.

funding profile

This project has attracted over $13.4 million in funding from a variety of sources including:

◗ Canada Foundation for Innovation	$5.20 million
◗ Ontario Innovation Trust	$2.98 million
◗ Statistics Canada	$1.05 million
◗ Various provincial and local partners and The National Archives of Canada	$2.77 million
◗ IBM	$1.48 million

Université d' University of Ottawa

Mitochondria Mysteries Explored

WORKING FROM HER own research laboratory at the University of Ottawa Heart Institute, Dr. Heidi McBride aims to understand how intracellular organelles communicate with each other in response to the metabolic demands of daily life. Thanks to recent advances in technology, researchers now have the tools to label individual proteins or organelles and actually film them as they move and function within the cell--somewhat as depicted in the film *Fantastic Voyage*. This breakthrough in cell biology has led Dr. McBride and other researchers to discover that the mitochondria—the energy powerhouse of the cell—do not sit contentedly performing metabolic feats of respiration, but are in fact incredibly dynamic.

With funds from the **Canada Foundation for Innovation** and the **Ontario Innovation Trust,** Dr. McBride has built an imaging centre and made a number of exciting observations. Dr. McBride and her research group have observed that mitochondria fuse with each other at least once every few minutes in all cells. This fusion behaviour joins other mitochondrial branching events such as mitochondrial division or fission and mitochondria "shape-shifting" which sees mitochondria change from tubular structures into rounded spheres. These observations pose the next question: why do mitochondria need to perform such acrobatics? To answer this question, Dr. McBride has blended microscopic video technology with biochemical approaches to unravel the molecular mechanisms governing mitochondrial dynamics. By focusing on the regulatory proteins that switch this behaviour on and off, Dr. McBride hopes her research will lead to a new understanding of mitochondria activity. Understanding how this organelle responds to the signals of the cell and organism is especially important considering the causal linkage to a variety of diseases such as Parkinson's and Huntington's.

In 2002, Dr. McBride was awarded the **Premier's Research Excellence Award,** enabling her to hire young trainees and build an effective team to address these important questions.

Dr. Heidi McBride is an internationally recognized scientist in the field of intracellular transport.

funding profile

Canada Foundation for Innovation	$181,514
Ontario Innovation Trust	$181,514
Premier's Research Excellence Award	$150,000 *
University of Ottawa Heart Institute	$140,000

*Two-thirds of each PREA is funded by the province and one-third is provided by the university.

Université d' Ottawa
University of Ottawa

National High Field Nuclear Magnetic Resonance Facility for Solids and Materials

Dr. Christian Detellier is working to bring a new Nuclear Magnetic Resonance imaging facility to Ottawa.

THE CITY OF OTTAWA will soon become home to one of the most powerful Nuclear Magnetic Resonance (NMR) imaging facilities in the world, thanks to the efforts of Dr. Christian Detellier, the University of Ottawa's Dean of Science, his colleagues from the National Research Council and universities from across the country. This new facility—named the National High Field Nuclear Magnetic Resonance Facility for Solids and Materials—will enable Canadian researchers to remain on the cutting edge of one of the most useful and versatile analytical technologies ever developed. "We wanted to build a facility for Canada that the provinces alone could not afford," says Dr. Detellier. Although located in Ottawa, it will be accessible to interested parties everywhere.

"It could be completely controlled by the Internet," observes Dr. Detellier. "Someone from Alberta could have their sample put in the machine, and then control everything from there. That's very exciting."

To appreciate how far this equipment has come in the past two decades, one of the first machines Dr. Detellier used had a magnetic field oscillating at a frequency of 60 MHz. In contrast, the planned national facility will operate at 900 MHz.

NMR functions by immersing a sample of material in a static magnetic field, then exposing it to the oscillating magnetic field. This interaction causes the nuclei within the sample's atoms to emit a unique signal that reveals molecular structures. The more powerful the field, the more information a user is able to obtain from that signal.

"With the new facility, you will be able to characterize the material much more effectively," says Dr. Detellier, adding that this objective is especially welcomed by anyone who has tried to use NMR on solids. "Until recently, it was a very complicated field, very difficult to get information out of it."

Yet an increasing amount of investigation focuses on new and largely unknown solid materials. For example, scientists continue to look for alloys of particular elements that might demonstrate superconductivity at high temperatures, a discovery that could have important industrial applications and help to explain this elusive physical phenomenon. It might be thought that creating such materials is the biggest obstacle to this goal but the problem is even more basic.

"The main challenge in the development of new materials is not their synthesis, but their characterization," says Dr. Detellier. "This becomes even more difficult with amorphous materials, such as plastics, where old stand-by systems such as X-ray diffraction no longer yield much useful information."

funding profile

Canada Foundation for Innovation	$4.4 million
Ontario Innovation Trust	$2.6 million
Government of Quebec	$888,000

Université d' University of Ottawa

The "Heart" of Mathematics

EVERY YEAR IN CANADA, about 22,000 people die of heart attacks. According to Dr. Victor LeBlanc, mathematics may help shed light on this deadly phenomenon. Dr. LeBlanc is Associate Professor in the Department of Mathematics and Statistics at the University of Ottawa, and Co-Founder (along with Prof. Yves Bourgault) of the Numerical Heart Laboratory, which is dedicated to the mathematical analysis and numerical simulation of the human cardiovascular system.

Dr. LeBlanc's research program, partly funded by a **Premier's Research Excellence Award (PREA)**, focuses on the mathematical analysis of wave propagation in excitable media and its application to the human heart. It is through a wave propagation of electricity that the heart contracts and pumps blood throughout the body. The laws governing this wave propagation are provided by mathematical models known as partial differential equations—Dr. LeBlanc's area of mathematical expertise. While using mathematics to solve these partial differential equations has potential for the propagation of electricity on the heart tissue, not all of these solutions would lead to a normal heartbeat. For example, certain solutions called spiral waves cause the heart to beat erratically—a condition that could deteriorate rapidly and lead to death.

Dr. LeBlanc's own research has shown that the geometrical properties of the underlying medium greatly influence the propagation of spiral waves. Heart muscle geometry includes anisotropy (alignment of muscle cells) and inhomogeneities—small arteries, veins or even pieces of diseased tissue that can attract spiral waves—among other things.

The **PREA** will allow Dr. LeBlanc and his students to continue to study the interplay between the human heart, partial differential equations and spiral waves.

Dr. Victor LeBlanc is using mathematics to study the human heartbeat.

funding profile

- **Premier's Research Excellence Award** **$150,000 ***

*Two-thirds of each PREA is funded by the province and one-third is provided by the university.

Université d' Ottawa
University of Ottawa

A Question of Balance

BALANCE—the ability to sit, stand and move efficiently—is an integral part of independent living. Imagine not being able to reach for, pick up and carry a cup of hot coffee or walk along a wooded path with hidden tree roots, branches or rocks. People with balance problems face these challenges as well as a greater risk of falls and injury.

Understanding how balance is learned and developed in infants and children, and how aging affects our abilities to efficiently regulate balance is crucial to the development of effective, evidence-based rehabilitation practices. With funding from a **Premier's Research Excellence Award**, Dr. Heidi Sveistrup has assembled a team of graduate and undergraduate students to further research these issues. Dr. Sveistrup and her team will develop and evaluate training programs, designed for the home, community and institution, that focus on the prevention of falls and their related injuries, and on new strategies for balance rehabilitation. These new rebalancing approaches will include the use of virtual reality and alternative exercises. Dr. Sveistrup's research will benefit specific at-risk populations and enhance the quality of life for these clients and their families.

Dr. Heidi Sveistrup is working to develop effective, evidence-based rehabilitation practices.

funding profile

- **Premier's Research Excellence Award** **$150,000 ***

*Two-thirds of each PREA is funded by the province and one-third is provided by the university.

Queen's UNIVERSITY

Breast Cancer Discovery Provides Clues for Prostate Treatment

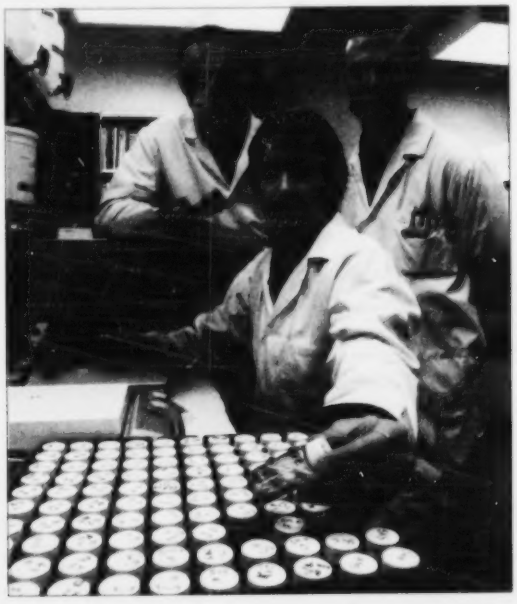
A QUEEN'S UNIVERSITY research team, led by Dr. Charles Graham, recently discovered a way to make breast cancer cells more responsive to chemotherapy. They are now investigating whether this discovery can be applied to effectively treat prostate cancer—the second leading cause of cancer deaths for men in North America.

Dr. Graham's team has demonstrated that when tumour cells are exposed to very low levels of oxygen they become resistant to the killing effects of anti-cancer drugs. Reduced oxygen levels contribute to the drug resistance by blocking the production of nitric oxide (NO) in the tumour cells.

"This was an exciting finding because it opened the possibility of using drugs such as nitroglycerine, which deliver NO or mimic its effects, to increase the sensitivity of cancers to conventional anti-cancer drugs," says Dr. Graham. "Most patients who die of prostate cancer do so because the tumour spreads and fails to respond to therapy."

Nitroglycerine is relatively inexpensive and has no significant side effects—key benefits of a drug that has been used to treat chest pain for more than 100 years.

Dr. Graham and his team also hope to develop a better understanding of how cancer cells become resistant to chemotherapy. While this research may result in new approaches to the treatment of patients with prostate cancer, it also has the potential of leading to novel ways of enhancing the efficacy of chemotherapy against other cancers.



Anatomy and cell biology graduate student Lisa Frederiksen examines cancer tissue, under the supervision of Drs. Robert Siemens (left) and Charles Graham (right).

funding profile

Canadian Institutes of Health Research	$405,475
Premier's Research Excellence Award	$150,000 *
Cellegy Canada Inc.	$152,435
US Army	$479,466

*Two-thirds of each PREA is funded by the province and one-third is provided by the university.

Queen's UNIVERSITY

"Polite" Computers that "Pay Attention"

WITH INCREASING NUMBERS of digital devices vying for our attention and time, researchers from the Human Media Lab (HML) at Queen's University are addressing the problem of the barrage of messages that people receive.

Current computers are generally designed to act in isolation, automatically processing volumes of e-mail, instant messages, phone calls and appointment notifications without consideration for where the user's attention is focused. As a result, today's user has to contend with frequent and often distracting interruptions. "Today's digital lifestyle has the unfortunate side effect of bombarding people with messages from many devices all the time, regardless of whether they're willing or able to respond," says HML Director Roel Vertegaal. "Like spam [unsolicited e-mail], this problem needs to be addressed."

HML researchers have developed a new concept that allows computers to better accommodate users' needs. The Attentive User Interface (AUI), rooted in research into the function of eye contact in managing human group conversation, offers a new paradigm that moves beyond the traditional desktop interface.

Dr. Vertegaal and his students, Jeffrey Shell, Alexander Skaburskis and Connor Dickie, are designing devices that determine the level of user attention and the importance of each message relative to what the user is doing. The devices then decide whether to "take a turn" in delivering their messages.

"The way in which we use computers has fundamentally changed," says Dr. Vertegaal. "We're moving computers from the realm of being merely tools, to being 'sociable' appliances that can recognize and respond to nonverbal cues."

Student Connor Dickie and HML Director Dr. Roel Vertegaal test a wearable eye contact sensor.

funding profile

Natural Sciences and Engineering Research Council	$96,000
Institute for Robotics and Intelligent Systems (Networks of Centres of Excellence)	$139,925
Premier's Research Excellence Award	$150,000 *
Communications and Information Technology Ontario (Ontario Centre of Excellence)	$223,501
Microsoft Research	$37,497

*Two-thirds of each PREA is funded by the province and one-third is provided by the university.

Queen's UNIVERSITY

The Other Side of Imaginary Friends

Psychology student Jennie Baxter observes a child at play in Queen's Early Experience Lab.

UNTIL RECENTLY, fantasy playmates were regarded as a sign of shyness or poor social development. But according to developmental psychologist Mark Sabbagh, imaginary friends may actually have the opposite effect.

Although having an imaginary friend was once considered rare, studies indicate that between 40 and 65 percent of all children at some point have imaginary friends. "Research has shown that children with imaginary friends are actually less shy and have better social skills," notes Dr. Sabbagh. He and doctoral student Jennie Baxter are now investigating the extent to which fantasy play allows young children to practise an important social skill: the ability to take another person's perspective.

"In most situations, we have really accurate intuitions about what another person is thinking or feeling, even when those thoughts and feelings are really different from our own," says Dr. Sabbagh.

While children's fantasy play does provide a kind of social practice, it also offers a unique opportunity for children to exert a sense of total control over a social interaction. "One of the interesting things we're looking at is how much children like to have control over their pretend play," says Ms. Baxter. For instance, when well-meaning parents try to direct how children play with their imaginary friends, the imaginary friends have a tendency to disappear. "We are interested in whether the richness of children's social fantasy play decreases when other people try to take that control away," she says.

funding profile

Natural Sciences and Engineering Research Council	$80,000
Social Sciences and Humanities Research Council	$76,174
Canada Foundation for Innovation	$123,200
Ontario Innovation Trust	$123,200

Queen's UNIVERSITY

Reducing Suffering and Community Health Expenditures

Dr. Margaret Harrison is investigating the effective treatment of leg ulcers.

LEG ULCERS ARE a common affliction among Canada's aging population. Despite the fact that there is a recognized "gold standard" treatment, they continue to plague thousands of Canadians and to contribute to rising community care expenditures.

With support from the Ottawa-Carleton Community Care Access Centre (CCAC) and the **Ontario Ministry of Health**, Dr. Margaret Harrison and her research team found in one large region that only 40 percent of people receiving home care for venous leg ulcers were treated with compression bandages, the most effective treatment.

Following the implementation of a new treatment protocol, Dr. Harrison's study showed that healing rates more than doubled; nursing visits dropped by almost one-third; and individual supply costs decreased by more than half.

"Since we know what needs to be done to heal venous leg ulcers, this was an ideal opportunity for implementing an 'evidence-based protocol' to ensure that current research gets put into practice," says Dr. Harrison. "This is a perfect instance of where we don't need more money, but where we need to do things differently."

With **Canadian Institutes of Health Research (CIHR)** support, Dr. Harrison's initial study has been expanded to determine whether it makes a difference if the protocol is delivered at home or in a nursing clinic. A concurrent study, funded by the **Social Sciences and Humanities Research Council**, examines how new evidence-based protocols may be successfully implemented.

Dr. Harrison's second **CIHR** study, involving CCACs in several Ontario regions, will determine the cost effectiveness and efficiency of different high-compression bandaging systems in home care delivery. It is the largest Canadian wound-care trial undertaken to date.

funding profile

Canadian Institutes of Health Research	**$206,135**
	$622,318
Social Sciences and Humanities Research Council	**$221,454**

Queen's UNIVERSITY

Crystal Clear: Protein Crystallography Offers New Ways to Understand Disease

DR. ZONGCHAO JIA, **Canada Research Chair** in Structural Biology, uses X-ray imaging techniques to study the 3-D crystalline structures of proteins. The X-rays, deflected by the atoms they hit, are recorded on detectors similar to those used in digital cameras. Computing resources at the Queen's University-based High Performance Computing Virtual Laboratory are then used to deduce the intricate 3-D protein structure from the recorded images. These images help illuminate a protein's properties, allowing Dr. Jia and his research team to glean information about the protein's structure and how it operates.

Dr. Jia's lab has been a leader in the structural study of antifreeze proteins, which prevent the formation of ice crystals within cells, shedding light on how some proteins allow certain species to survive over winter. Their findings could prove important in creating ways to reversibly freeze human tissue.

X-ray crystallography also enables researchers to better understand proteins that play an important role in diseases and disorders such as Alzheimer's, muscular dystrophy and heart attacks. Using X-ray crystallography resources to further his studies of different proteins of biological importance, Dr. Jia is also working on cancer-related proteins that could prove to be effective drug targets in the treatment of various immune disorders.

"Protein structure research is intricate work requiring advanced research techniques," says Dr. Jia. "Support from the **Canada Foundation for Innovation, Ontario Innovation Trust, Canadian Institutes of Health Research** and **Natural Sciences and Engineering Research Council** provides us with the very necessary resources that make this level of analysis possible."

▼ Dr. Zongchao Jia using an X-ray imaging detector.

funding profile

Zongchao Jia

◗ Canada Research Chair	$500,000
◗ Canadian Institutes of Health Research	$620,000
◗ Natural Sciences and Engineering Research Council	$214,400
◗ EWR Steacie Memorial Fellowship 2003	$180,000
◗ Canada Foundation for Innovation	$125,000
◗ Ontario Innovation Trust	$125,000
◗ Premier's Research Excellence Award	$150,000 *

High Performance Computing Virtual Laboratory

◗ Natural Sciences and Engineering Research Council	$198,000
◗ Canada Foundation for Innovation	$5,189,000
◗ Ontario Innovation Trust	$5,189,000
◗ Ontario Research and Development, Challenge Fund	$6,949,127
◗ Sun Microsystems	$18 million

*Two-thirds of each PREA is funded by the province and one-third is provided by the university.

RYERSON UNIVERSITY

Healthier Bones Focus of Research

AS ASSISTANT PROFESSOR in Ryerson University's School of Math, Physics and Computer Science, Dr. Ana Pejović-Milić is among a group of researchers who, with support from the **Natural Sciences and Engineering Research Council**, are conducting studies in the new and growing field of medical physics. This discipline rests on the application and use of physics in medicine, and Dr. Pejović-Milić's work has practical implications for understanding diseases such as bone degeneration.

Dr. Pejović-Milić is currently developing diagnostic techniques that will be used to assess the health consequences of aluminum and strontium in the human body. It has been discovered that people with increased levels of aluminum in their bone, such as dialysis patients and workers in the auto industry, face health problems, while strontium ranelate has a potential as a new medication for treatment of osteoporosis.

Her current studies, at McMaster University, are predominantly funded by the **Natural Sciences and Engineering Research Council (NSERC)**, along with another joint **NSERC** grant with McMaster University and the University of Guelph. Dr. Pejović-Milić has also received substantial research funding from both federal and provincial granting agencies such as **Canada Foundation for Innovation (CFI)**, **Ontario Innovation Trust (OIT)** and **NSERC**.

With the **CFI** and OIT grants, Dr. Pejović-Milić is working on developing a new laboratory that could place Ryerson University at the forefront of trace and minor elements research.

Dr. Pejović-Milić is currently participating in the development of a graduate-level program and is working on an innovative plan to develop a contemporary science program for undergraduates at Ryerson University.

Dr. Ana Pejović-Milić is part of the growing field of medical physics.

funding profile

- **Natural Sciences and Engineering Research Council** — **$92,000**
  —Equipment Grant — **$22,211**
- **Canada Foundation for Innovation,** — **$43,625**
- **Ontario Innovation Trust** — **$43,625**

RYERSON UNIVERSITY

Mercury an Arctic Mystery

DR. JULIA LU, Professor in Ryerson's Department of Chemistry, Biology and Chemical Engineering, and recent winner of the **Premier's Research Excellence Award**, is one of a number of scientists working to determine why there are such curiously high levels of mercury contamination in the otherwise pristine environment of the Arctic.

In support of her research, Dr. Lu has been awarded substantial funding from sponsors such as the **Natural Sciences and Engineering Research Council (NSERC), Canada Foundation for Innovation, Ontario Innovation Trust** and **Environment Canada.** With her **NSERC** funding, in addition to hiring three graduate students, postdoctoral fellows and research assistants, Dr Lu has acquired a mercury speciation system that can distinguish between different forms of mercury in the atmosphere.

Dr. Lu's group is testing this system to ensure that it can positively identify and quantify different forms of mercury. Clarifying the type of mercury will explain the rate at which the mercury is deposited, how it is transported, what chemical reactions may take place and how mercury can be removed from sources of emission.

Dr. Lu will continue putting her mercury speciation system through rigorous testing as her studies progress. Her research will increase knowledge about the situation not only in the Arctic, but also in the Antarctic and in urban and rural environments.

Dr. Julia Lu's research focus is mercury contamination in the Arctic.

funding profile

Natural Sciences and Engineering Research Council	
—Equipment Grant	**$40,000**
—Discovery Grant	**$83,282**
—Research Tools and Instruments	**$20,000**
—Metals in the Environment Research Network	**$19,983**
Environment Canada	**$73,500**
Canada Foundation for Innovation,	**$56,000**
Ontario Innovation Trust	**$61,840**
Premier's Research Excellence Award	**$61,840**
	$150,000 *

*Two-thirds of each PREA is funded by the province and one-third is provided by the university.

RYERSON UNIVERSITY

Reducing the Experience of Stigma for Youth Recovering from First Episode Schizophrenia

ASSOCIATE PROFESSOR Elizabeth McCay and her research team from Ryerson and other Ontario universities have developed a novel approach to minimize the stigmatizing impact of a first episode of mental illness on young adults.

They are evaluating a group intervention that aims to help youth coping with schizophrenia not only to resist feeling overwhelmed by the illness but also to embrace a healthy sense of self. The overall goal is to encourage participants to minimize identification with the illness, promote hopefulness, reduce stigmatization and identify attainable goals. Ultimately, this group intervention could prevent a young and vulnerable population from experiencing a downward spiral of hopelessness, poor self-esteem and a preoccupation with illness. If effective, it could be adaptable to other clinical settings across Canada. A number of graduate students have become interested in this field and have chosen to focus their studies in the area of psychosocial response to early schizophrenia.

The study is supported by grants from the **Canadian Institutes of Health Research** (including a **New Investigator Award**) and the **Social Sciences and Humanities Research Council**.

Dr. McCay is also collaborating with Dr. Heather Beanlands, her **New Emerging Team** grant co-investigator, on two related research initiatives: to develop a range of group interventions that will address self-definition and stigma in various chronic illnesses; and to examine psychosocial issues, with a focus on gender, in kidney disease.

Back Row (left to right): Ms. Oneka Pratt, research assistant; Dr. Heather Beanlands, Associate Professor; Dr. Elizabeth McCay, Associate Professor, CIHR New Investigator; Ms. Karen Yee, research assistant.

Front Row (left to right): Ms. Carla Kenyon, research assistant; Ms. Tanya Vishnevsky, research co-ordinator.

funding profile

◗ Canadian Institutes of Health Research	$150,657
—New Investigator Award	$250,000
—New Emerging Team Program (co-investigators)	$1,248,450
◗ Social Sciences and Humanities Research Council	$18,173

RYERSON UNIVERSITY

Oil Research that is Out of this World

"IT'S A PARADOX," acknowledges Dr. Ziad Saghir, Mechanical Engineering Professor at Ryerson University, about his current microgravity research project. The paradox is sending oil into space to understand what happens when it's under the Earth's surface.

His current research project investigating the effects of oil in weightlessness began in September 2000. The goal of the project is to measure the thermal and molecular diffusion of different hydrocarbon mixtures. Dr. Saghir's role is to predict how the experiment will perform prior to and during the flight using numerical simulations. Later, this information will be analyzed, and the results will be used to predict the characteristics of oil deep underground, providing a more accurate measurement for determining the size of oil reserves. Dr. Saghir also sees the application of his microgravity research in material sciences and areas such as protein growth.

Dr. Saghir has received funding from the **Centre for Research in Earth and Space Technology**, the **Natural Sciences and Engineering Research Council (NSERC)** and the **Canadian Space Agency**. This includes NSERC funding for a four-year project in double diffusion convection, and a new three-year collaborative health research project.

Dr. Saghir's team, consisting of one research scientist, one postdoctorate researcher, one PhD student, three masters students and three undergraduate students, has collaborated with leading science professionals, published its results and been selected to continue its research on board the International Space Station. With funding already secured, they will work with teams from Belgium, Russia and France.

Dr. Ziad Saghir is conducting microgravity research on oil.

funding profile

- **Natural Sciences and Engineering Research Council** $103,000
- **Canadian Space Agency, Space Science Program** $420,000
- **Premier's Research Excellence Award** $75,000 *
- **Materials and Manufacturing Ontario (Ontario Centre of Excellence)** $40,000
- **Centre for Research in Earth and Space Technology (Ontario Centre of Excellence)** $250,100

*Two-thirds of each PREA is funded by the province and one-third is provided by the university.

RYERSON UNIVERSITY

The Pros and Cons of Broadband Network Access for Canadians

AS HIGH-SPEED INTERNET access becomes more and more common in Canadian homes, governments from around the world are promoting the benefits of this kind of network access as an enabler of the new economy. But how effective and how necessary are broadband networks?

Ryerson researcher Catherine Middleton's current goal is to understand the adoption and usage of broadband networks (high-speed Internet access) and services in Canadian homes. With support from the **Social Sciences and Humanities Research Council** and Ryerson University, Dr. Middleton will be conducting a rigorous analysis of consumers' demand and usage of broadband network access. This will allow her to develop a better understanding of consumer patterns and the advantages and disadvantages of broadband. Her work will address questions about the demand for broadband, the perceived and actual benefits for consumers and how it should be supplied to consumers.

Her previous studies suggest that broadband networks provide value by connecting people to other people, and that simple connectivity at low bandwidths can provide people with useful services.

Dr. Middleton works with a graduate student from the Communications and Culture program and plans to add another student to her research team next year.

Dr. Catherine Middleton is studying the effectiveness of broadband networks.

funding profile

- **Social Sciences and Humanities Research Council** — **$122,000**

UNIVERSITY OF TORONTO

Key Piece of Canada's History Goes Online

HISTORY STUDENTS ACROSS Canada will benefit from bumped-up resources this fall when the Library and Archives of Canada launches an online version of the *Dictionary of Canadian Biography* (DCB), thanks to a landmark licensing deal.

The two-year, $1.6 million deal between U of T, Université Laval and the Department of Canadian Heritage allows the Library and Archives of Canada to publish the DCB on its web site, giving history buffs around the world a new window into the lives of Canadians.

Founded in 1959 at U of T and developed in partnership with Laval, the DCB is a 14-volume reference book containing the biographies of over 8,000 noteworthy Canadians, from prime ministers and judges to artists and hockey players. It also profiles average Canadians, including farmers, carpenters and even some criminals.

"From the beginning, the intent was to represent society as a whole," says General Editor Ramsay Cook.

Each biography is based on original research rather than on obituaries or existing profiles and is written in both English and French. The biographies are organized by decade in each volume. The 15th volume, set to be published in early 2005, covers the period from 1921 to 1930.

A CD-ROM version of the dictionary—made possible by significant investments from the **Millennium Bureau of Canada**, the *National Post* and Hollinger Inc., and Historica—was launched in 2000 and distributed to every high school, college, university and public library in Canada. The online version, which went live in November 2003, will broaden that reach even further.

The licensing arrangement serves two important purposes, says Professor Cook. "It gives the DCB project a much-needed measure of financial stability so that we can continue our work, and it also offers something really valuable to the general public."

Photo: Susan King

Biography's U of T team (left to right): David Roberts, Ramsay Cook, Mary Bentley, and Robert Fraser.

funding profile

- **Social Sciences and Humanities Research Council (Consortium funding)** **$500,000**
- **Department of Canadian Heritage (multimedia license)** **$1.6 million**

UNIVERSITY OF TORONTO

Easing Traffic Congestion

DR. BAHER ABDULHAI is investigating a growing problem in major Canadian cities—traffic congestion. As the Founder and Director of the University of Toronto's Intelligent Transportation Systems (ITS) Centre and Testbed, Dr. Abdulhai and his team are developing ways to ease the negative impact of our car-obsessed society, from traffic jams to decreased safety on our roads to pollution.

The only facility of its kind in Canada, the Centre combines state-of-the-art technology with what Dr. Abdulhai calls a "melting pot" of researchers and practitioners, and is linked to the City of Toronto and to Ontario Ministry of Transportation traffic management centres that provide real-time feeds of traffic flow over various roadways, 200 traffic cameras, ramp metering devices and changeable text message billboards.

Recently, the ITS testbed proved to be an excellent resource for Toronto planners, as discussions about the Gardiner Expressway kicked into high gear. At the request of the Toronto Waterfront Revitalization Corporation, which is proposing to bury a portion of the Gardiner to improve the beauty of Toronto's shoreline property, Dr. Abdulhai conducted a simulation to predict how the proposed plan would affect the commute times of the 175,000 vehicles that use it everyday.

Dr. Abdulhai and his colleagues are now refining another simulation that would leave the Gardiner standing. At the same time they are developing an incident detection system that would automatically detect problems such as accidents or traffic jams. "We hope that whenever we finish a particular piece of research, we can give it to either the city or the ministry or both to try to put the improvements into action."

Photo: Steve Frost

Dr. Baher Abdulhai is working to improve traffic congestion in Toronto.

funding profile

Natural Sciences and Engineering Research Council	$68,000
Transport Canada	$120,000
Canada Foundation for Innovation	$176,000
Ontario Innovation Trust	$176,000
Ontario Research and Development Challenge Fund	$534,135
Castle Rock consultants Inc.	$196,000

UNIVERSITY OF TORONTO

Exploring Galaxies at the Speed of Light

Mackenzie, pictured with (left to right): third-year student Adrian Martin; CITA's Computing Facility Manager Chris Loken; Prof. Ue-Li Pen; and first-year student Taylor Martin.

THANKS TO a state-of-the-art supercomputer, University of Toronto astronomy and astrophysics researchers are gaining a better understanding of planets, galaxies and black holes.

Part of the Department of Astronomy and Astrophysics and the Canadian Institute for Theoretical Astrophysics (CITA), the new computer was ranked as the fastest computer in Canada and the 38th fastest in the world. Nicknamed Mackenzie, it is being used to carry out fundamental astrophysical research into a wide variety of topics, including the evolution of planetary disks, the development of spiral structure in galaxies, the formation of large-scale structure in our universe and the determination of fundamental cosmological parameters from Cosmic Microwave Background data.

"An essential element of modern astrophysics is the ability to carry out large-scale simulations of the cosmos, to complement the amazing observations being undertaken," said Prof. Peter Martin, Chair of the Department of Astronomy and Astrophysics and a CITA investigator. "With the simulations possible on this computer, we have in effect a laboratory where we can test our understanding of astronomical phenomena ranging from the development of structure in the universe over 14 billion years ago to the development of new planets in star-forming systems today."

Prof. John Dubinski has used the new computer to examine both the formation of cosmological structure and the collisions of galaxies by simulating the gravitational interaction of hundreds of millions of particles representing stars and the mysterious dark matter. The anticipated collision of the Milky Way Galaxy with our neighbouring Andromeda galaxy—an event predicted to take place in three billion years—has been modeled at unprecedented resolution.

New simulations on the formation of supermassive black holes, again with the highest resolution to date, have been carried out by his colleagues Professors Ue-Li Pen and Chris Matzner. They have already uncovered clues that may explain the mystery of why the black hole at the centre of our galaxy is so much fainter than had been expected theoretically.

Based on the computer's phenomenal success, the team has proposed to build the "Universe Simulator," which would be some 20 times faster than Mackenzie and rank among the top few in the world.

funding profile

Canada Foundation for Innovation	$448,000
Ontario Innovation Trust	$448,000

UNIVERSITY OF TORONTO

Speeding up the Healing Process

Photo: Laura Arus

Prof. Molly Shoichet is part of the research team investigating a biodegradable bone structure.

UNIVERSITY OF TORONTO scientists have developed a biodegradable scaffold, similar in structure to a dish sponge, that significantly speeds the rate of bone healing. The scaffold, which eventually dissolves, increases healing rates and offers a potential new treatment for bone loss in cases such as trauma or spinal fusions.

"We have been successful in stimulating cell and tissue growth in the laboratory and animal models and in replacing bone with bone, the underlying principle of bone tissue engineering," says co-investigator Molly Shoichet, Professor of Chemical Engineering and Applied Chemistry at the Institute for Biomaterials and Biomedical Engineering (IBBME).

Bone automatically replaces itself, allowing injuries such as fractures to heal. But in some traumatic cases, there is too much damage for the bone to heal on its own. Bone grafting, or moving bone from one body part to another, is a common solution, says IBBME Co-Investigator John Davies. "The problem is that there's often not enough of the patient's bone to move from one site to another, so you've got to resort to other means of generating bone," says Professor Davies.

Professors Shoichet and Davies; Jeff Fialkov, a surgeon at Sunnybrook and Women's College Health Sciences Centre; and graduate student Chantal Holy started experimenting in 1995 with polymers and natural bone tissue to find a new method of bone regeneration. They developed a biodegradable scaffold with polymers similar to those found in dissolving sutures and with a structure similar to a large-pored dishwashing sponge.

The team implanted the scaffolds—seeded with bone marrow cells—in the damaged femur bones of rabbits. Within six weeks, the animals could walk on the legs containing the scaffolds. Within eight weeks, the bone marrow cells had developed into bone throughout the entire scaffold.

The team now plans to study the scaffolds in larger animals, with the ultimate goal of creating a human treatment that could speed the early healing of bone trauma.

funding profile

Canada Research Chair	$500,000
Canadian Institutes of Health Research	$442,778
Natural Sciences and Engineering Research Council	$390,666
Ontario Research and Development Challenge Fund	$249,000
Premier's Research Excellence Awards	$150,000 *
Xerox Research Centre of Canada	$62,540

*Two-thirds of each PREA is funded by the province and one-third is provided by the university.

UNIVERSITY OF TORONTO

Study Shows Diet as Good as Drug for Lowering Cholesterol

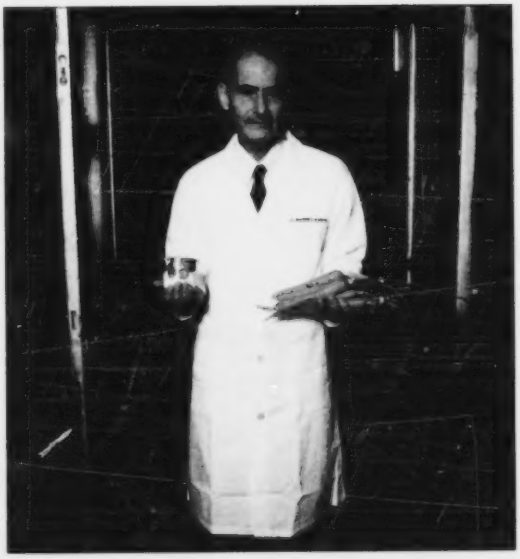


Photo: Adrian Byrne

Prof. David Jenkins is studying a dietary alternative to control cholesterol.

RESEARCHERS AT THE University of Toronto and St. Michael's Hospital have shown that a vegetarian diet composed of specific plant foods can lower cholesterol as effectively as a drug treatment.

The study, published in the *Journal of the American Medical Association* in July 2003, compared a diet of known cholesterol-lowering, vegetarian foods to a standard cholesterol-reducing drug called lovastatin. The special diet combined almonds, soy proteins, high-fibre foods such as oats and barley and a special margarine with plant sterols (found in leafy green vegetables and vegetable oils).

This diet lowered levels of LDL cholesterol – the "bad" cholesterol known to cause clogging in coronary arteries – in subjects by almost 29 per cent, compared to a 30.9 per cent decrease in the lovastatin subjects.

Lead author David Jenkins, Professor in U of T's Department of Nutritional Sciences and Director of the Clinical Nutrition and Risk Factor Modification Centre at St. Michael's Hospital, says the study could have far-reaching implications for public health. "As we age, we tend to get raised cholesterol, which in turn increases our risk of heart disease. This study shows that people now have a dietary alternative to drugs to control their cholesterol, at least initially."

Professor Jenkins points out that large numbers of people with high cholesterol are being put on medication before they are able to give diet an adequate trial. He adds that while many people may still require drugs to lower their cholesterol his team has demonstrated an effective alternative for those who are prepared to control their food choices.

The study, which has garnered widespread attention and was picked up by CNN, may have important implications for provincial savings on prescription drugs.

funding profile

Canada Research Chair	$1.4 million
Natural Sciences and Engineering Research Council of Canada	$96,752
Heart & Stroke Foundation of Ontario	$230,144
Almond Board of California	$761,740
Loblaw Cos. Ltd.	$395,000
Unilever Research Vlaardingen	$125,000
National Starch & Chemical Company	$52,315

TRENT UNIVERSITY

Freshwater Biogeochemistry

DR. PETER DILLON, Director of Trent's Water Quality Centre, explores the relationships between components of terrestrial and aquatic ecosystems. Dr. Dillon examines how large-scale environmental stressors such as acid deposition, climate change, trace-metal contamination, ozone depletion and nutrient enrichment impact the chemistry of terrestrial and aquatic ecosystems. Recent studies by Dr. Dillon and his team have focused on the sulphur cycle, the carbon cycle, trace-metal contamination and cycling, the recovery of ecosystems following reduced acid deposition, the generation of acid-neutralizing capacity in ecosystems and nutrient budget-modelling and interpretation. These projects have centred on a set of lakes and catchments with long-term (25-year) hydrologic, meteorologic, physical, chemical and biological data.

Dr. Dillon says, "Our work is directly and deliberately related to policy guidelines on acid gas emissions. Our previous efforts have had considerable impact on policy development and some of our new findings will be reflected in the next state-of-the-science report."

Dr. Dillon holds an Industrial Research Chair funded by the **Natural Sciences and Engineering Research Council** and Ontario Power Generation Inc. —a corporation with a strong interest in research on acid deposition, climate change and contaminant introduction to the environment. The Water Quality Centre, Dr. Dillon's research base, is funded by the Canada Foundation for Innovation and the **Ontario Innovation Trust**.

Dr. Peter Dillon is examining the impact of environmental stressors on aquatic and terrestrial ecosystems.

funding profile

◗ Natural Sciences and Engineering Research Council of Canada	$185,840
—Major Facilities Access and Infrastructure	$201,600
—Industrial Research Chair	$195,200
—Strategic Research Grant	$257,000
◗ Canada Foundation for Innovation	$670,000
	$83,600
◗ Ontario Innovation Trust	$670,000
	$83,600
◗ Ontario Power Generation	$1,025,300

TRENT UNIVERSITY

The DNA Cluster Project: Capturing the Hope of an Entire Community

BRADLEY WHITE, Professor and **Canada Research Chair** in Conservation Genetics and Biodiversity, is a world leader in DNA research. He is the driving force behind the Wildlife Forensic DNA Laboratory and the Natural Resources DNA Profiling and Forensic Centre—both located at Trent—and the development of a robotic system capable of providing high-volume, low-cost DNA sampling and profiling.

In recent months, Dr. White's attention has focused on the Greater Peterborough Region DNA Cluster. This ambitious initiative involves a multi-tiered partnership that would integrate much of Dr. White's DNA work through linkages with industry, community groups and government. The DNA Cluster will make the greater Peterborough region a centre for excellence in DNA.

A number of partners are ready to participate in this new venture including Fleming College, the Ontario Ministry of Natural Resources and Maxxam Analytics—a company with considerable commercial experience in DNA profiling and forensic testing.

The Greater Peterborough Area Economic Development Corporation, the **Canada Foundation for Innovation** and the **Ontario Innovation Trust** are playing key roles in transforming the Centre from a dream into reality. Additional funding of $3.6 million has just been announced by the **Canada Foundation for Innovation** for a new multi-faceted research and development centre to house the project. The new centre will include both public- and private-sector laboratories and associated operations from Trent University and would focus on DNA profiling, automation, molecular diagnostics, geomatics and forensics.

funding profile

Canada Research Chair	$1.4 million
Natural Sciences and Engineering Research Council of Canada	$156,901
Canada Foundation for Innovation	$440,000
Ontario Innovation Trust	$440,000

▼ Dr. Bradley White is spearheading the DNA Cluster Project, which will link industry, community groups and government.

TRENT UNIVERSITY

Providing a Home for International Political Economy Studies at Trent

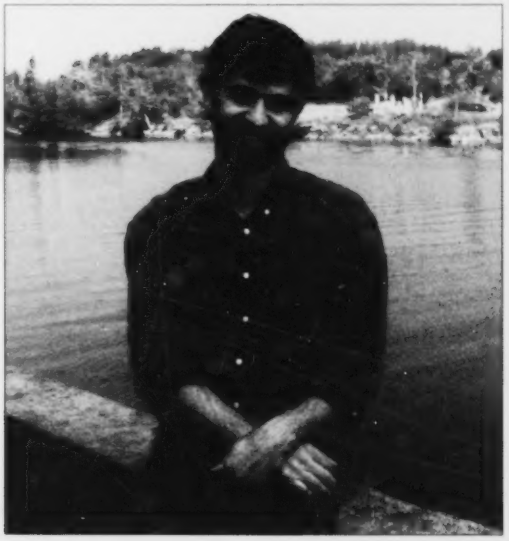
FUNDING FROM THE **Canada Foundation for Innovation** and the **Ontario Innovation Trust** has helped to create a newly designated space for the study of international political economy (IPE) at Trent. The Trent International Political Economy Centre (TIPEC) will foster further advancement in this field and bring together professors and researchers who are at the forefront of political economy thought at the university—Professors Eric Helleiner, Jennifer Clapp, Mark Neufeld, Andreas Pickel and Derek Hall.

In addition to consolidating the proximity of these professors and researchers to one other, the Centre will enable TIPEC-sponsored academic talks and workshops. A working paper series has already been developed featuring topics such as Towards a North American Currency, Negotiating Rules for Agricultural Biotechnology and Chemicals, and The International Ecology of Shrimp Agriculture and Industrial Plantation Forestry in Asia.

The Centre is committed to the multidisciplinary nature of IPE and is designed to strengthen Trent's research capacity in this area. A key goal is to break down disciplinary divisions and integrate insights from various fields of study concerned with IPE issues.

TIPEC members plan to examine issues that go beyond classical IPE scholarship, such as relationships between states and markets or power and wealth. How these relationships interact with environmental issues, spatial and historical contexts, social hierarchies and cultures and identities is another area of study. TIPEC members are also questioning the traditional separation of "domestic/national" political economy from "international/global" political economy and are encouraging research that explores relationships between local, national, regional and global political-economic processes and structures.

▼ Canada Research Chair, Dr. Eric Helleiner is the Director of Trent's new International Political Economy Centre.



funding profile

◗ Canada Research Chair	$500,000
◗ Social Sciences and Humanities Research Council	$44,020
◗ Canada Foundation for Innovation	$75,000
◗ Ontario Innovation Trust	$75,000

TRENT UNIVERSITY

Tracing Drug Residues in Canadian Waterways: Trent's Water Quality Centre Leads the Way in National Research

Dr. Chris Metcalfe is leading the only group of Canadian researchers to examine pharmaceutical drug residues in Canadian waterways.

DR. CHRIS METCALFE and his research team at Trent University are breaking new ground in the area of water quality research. They are studying the presence of pharmaceutical drug residues in Canadian waterways and have identified several drugs that exist in lakes and rivers. The only group in Canada to examine this important issue, the Trent team could play a pivotal role in developing policy that links environmental assessments to the regulation of pharmaceutical products. European countries have already implemented these types of laws.

Pharmaceutical drugs get into natural waterways through human consumption. Our bodies absorb only 30 to 70 percent of ingested medication, with the level of absorption dependent on the particular drug and individual physiology. Medication not absorbed by the body is excreted and flushed into sewage systems. However, sewage treatment facilities are not designed to degrade these components so they enter our waterways as part of treated sewage effluent.

Since 1998, Trent researchers have tested water from 18 sewage outfalls in Canadian cities and have discovered the presence of several drugs, including the anti-inflammatory drug Naproxen and the anti-epileptic and post-traumatic stress disorder drug, Carbamazepine.

The effects of these drugs on the environment are unknown. Dr. Metcalfe and his team are attempting to provide the necessary data to create an accurate picture of drug presence in our waters. Their findings will lead researchers to other questions. In fact, Dr. Metcalfe has already established a collaboration with the University of Ottawa, where lab-based studies are investigating drug effects on fish.

Funding from the **Canada Foundation for Innovation** and the **Ontario Innovation Trust** has helped the Water Quality Centre at Trent obtain the state-of-the-art equipment needed for this type of analysis, which will benefit the health of Canadians and the Canadian environment.

funding profile

◗ Natural Sciences and Engineering Research Council —Strategic Research Grant	$125,000 $468,000
◗ Canada Foundation for Innovation	$725,250
◗ Ontario Innovation Trust	$725,250

TRENT UNIVERSITY

Global Warming: Greenhouse Gas and Radiative Forcing Capacity

DR. WAYNE EVANS, one of the world's top ozone researchers, is studying ground-level ozone with support from the **Ontario Research and Development Challenge Fund** and Enbridge Consumers Gas. Ground-level ozone is formed when certain air pollutants come into contact with rays from the sun; it can be particularly detrimental to the environment.

Dr. Evans uses remote-sensing technology such as the space shuttle, satellites, balloons, aircraft and ground-based locations to analyze ozone-layer depletion, particularly in the polar regions, southern Canada and Mexico. Chlorofluorocarbons, methane and carbon dioxide are a few of the atmospheric gases examined through these testing instruments, with the aim of measuring the radiative forcing capacity of each gas. Dr. Evans also profiles specific greenhouse gases and the effects they have on the ozone layer.

Dr. Evans says, "While my team was the first to do this type of research, our research has evolved and now we are measuring gas concentrations and doing air pollution research. We are looking at gas concentrations—particularly ozone—in the lower part of the atmosphere, under the clouds. We used to be able to measure this on days with clear skies only, but now we have developed a new technique for measuring air pollutants in the boundary layer."

Dr. Wayne Evans is examining the depletion of the ozone layer.

funding profile

- **Natural Sciences and Engineering Research Council** **$156,000**
  —Collaborative Research Opportunities **$35,000**
- **Canadian Foundation for Climate and Atmospheric Science** **$204,000**
- **Ontario Research and Development Challenge Fund** **$145,000**

University of Waterloo

Raising the Stakes in Communication Pedagogy

RESEARCH IS UNDERWAY at the University of Waterloo into human performance and interpersonal communication. In these high technology times, technology can distance people from face-to-face interaction and create barriers and misunderstandings. Dr. Diana Denton, Professor of Interpersonal Communication, with the Department of Drama and Speech Communication is studying how to humanize technology to enhance human communication and performance.

Through the use of videotape and videoconferencing technology, Dr. Denton is investigating spoken and gestural communication within the contexts of leadership, interpersonal communication, conflict management and theatrical production. This research will show the impact of communication technologies on human knowledge, understanding and experience.

Based in the new Canadian Centre of Arts and Technology laboratory, Dr. Denton's primary research focuses on people-to-people interactions and people-to-technology interactions. The former includes how people make meaning in a variety of modes; how these meanings affect attitudes, behaviours, beliefs and actions; and how designers might improve the experience of interactive communication. The latter includes the reassessment of some of the most significant theoretical assumptions in communication and theatre studies.

Dr. Denton has a number of communication research projects underway. The project Witnessing Conflict: An Analysis of Participant Behaviour studies the behaviours adopted in situations that hold the potential for conflict.

Another project—Conflict Management in Theatre Production—focuses on significant issues facing theatre scholars. It involves observing and gathering data from all aspects of the production process from the readings, discussions or improvisations at the start of a rehearsal to the first public performance.

Dr. Diana Denton at work in the new Canadian Centre of Arts and Technology laboratory.

funding profile

Canada Foundation for Innovation	$84,352
Ontario Innovation Trust	$84,352
Quarry Integrated Communications	$15,000

University of Waterloo

Functional Genomics Research Aids Agriculture and Health

BREAKTHROUGH RESEARCH FINDINGS by Dr. John Thompson and his co-workers at the University of Waterloo have exciting implications for both agriculture and human health. Together, they have discovered the encoding proteins of two powerful genes that comprise a "switch" for regulating programmed cell death.

"These genes are present in both plants and mammals, including humans, and the switch may be a mechanism for controlling cell death. When the switch is on, cells die, and when the switch is off, they grow and proliferate," says Dr. Thompson. These genes have broad application in combating a range of human diseases, such as cancer, heart disease, glaucoma and Alzheimer's.

Programmed cell death in plants is termed senescence. Transgenic plants in which the death switch has been turned off delay senescence. This can enhance the shelf life of perishable produce such as fruits, vegetables and flowers. Keeping the death switch turned off also increases seed yield and plant tolerance to environmental stress.

Programmed cell death in humans is termed apoptosis, and many diseases are attributable to abnormal apoptosis. In the event of cancer, for example, cells targeted to undergo apoptosis are unable to turn on the death switch and proliferate to form a tumor. Conversely, other diseases such as glaucoma are a manifestation of premature apoptosis.

"As in plant cells, so in human cells, transgene technology can be used to turn the death switch on and off, and this may ameliorate human diseases arising from abnormal apoptosis," says Dr. Thompson.

When the death switch is turned on in human colon carcinoma cells, apoptosis is induced and the cancer cells die. Similarly, the induction of premature apoptosis in human cells can be prevented by turning the death switch off.

Dr. John Thompson reviews a research project with student Linda Nowack.

funding profile

◗ Natural Sciences and Engineering Research Council	$118,000
◗ Senesco Technologies, Inc.	$700,000

University of Waterloo

The UW institute for Quantum Computing

A NEW WAY of computing based on how nature behaves at the atomic level—where particles might exist in several states at once—has taken a quantum leap at the University of Waterloo.

Within the next 10 years, researchers believe that quantum computing will become powerful enough to break the cryptographic codes that protect financial and military secrets. Conversely, it may also hold the promise of making sensitive information more secure than ever before.

There's even the potential to revolutionize a whole range of existing technologies and create new ones as it opens new windows on the nature and origin of the universe. It could change the way we think about information—and even reality itself.

Leading this "revolution" at the University of Waterloo is Physics Professor Raymond Laflamme. A native of Quebec City, Dr. Laflamme left the Los Alamos National Laboratory in New Mexico to head UW's newly launched Institute for Quantum Computing.

Dr. Michele Mosca, a UW graduate and former research assistant at Los Alamos, is the Institute's deputy director. A mathematics professor specializing in combinatorics and optimization, he is researching quantum algorithms and cryptography.

The Institute brings together researchers from science, mathematics and engineering. In collaboration with their counterparts at the nearby Perimeter Institute of Theoretical Physics, they are making Waterloo one of the strongest centres of quantum information research in the world.

Dr. Raymond Laflamme, head of the Institute for Quantum Computing at the University of Waterloo, is studying how nature behaves at the atomic level.

funding profile

Canada Research Chair	$1,400,000
Natural Sciences and Engineering Research Council	$60,000
Canada Foundation for Innovation	$4,150,587
Ontario Innovation Trust	$3,252,472
Ontario Research and Development Challenge Fund	$2,975,000
Premier's Research Excellence Award	$150,000 *
Canadian Institute for Advanced Research	$90,000
Industry	$5,545,947

*Two-thirds of each PREA is funded by the province and one-third is provided by the university.

University of Waterloo

Innovative Research for Canadian Roads and Pavement

Dr. Susan Tighe is researching ways to make roads and airport runways safer and longer lasting.

RESEARCH IS UNDERWAY at the University of Waterloo's Centre for Pavement and Transportation Technology to make roads and airport runways safer and more durable.

Research at the Centre aims to bring the benefits of leading edge technology to conventional paving practice in design, construction, maintenance and rehabilitation. Ultimately, findings from this research will lead to better management of Canada's highway infrastructure.

Dr. Susan Tighe, a professional engineer and holder of the **Premier's Research Excellence Award,** is the principal researcher. She works extensively with the Greater Toronto Airport Authority and holds research contracts with the Ontario Ministry of Transportation, Cement Association of Canada and Public Works Government Services Canada.

As a member of an expert task group, Dr. Tighe oversees data analysis of the largest long-term pavement performance program in the world. Dr. Ralph Haas, who pioneered the systems concept and development of engineering technology for managing networks of paved roads, is also involved.

Through targeted basic research, their laboratory and field research is generating technical innovations and helping the paving industry to cope with rapid change and demands for high performance. This research involves evaluating asphalt, concrete, structural designs and recycled materials in cold climates, and searching for more effective management and improved safety through advanced computing.

Dr. Tighe and her team are also exploring maintenance and construction methods and cost effectiveness; conducting research on sensing technologies involving pavement icing; and reviewing safety improvements and economic effectiveness on paved and partially paved highway shoulders.

UW is establishing an integrated laboratory and test track facility, along with enhanced computer applications in paving technology, to educate and train future experts. Research programs into pavement construction, preservation and sustained development, roadway safety and structural innovations are also underway.

funding profile

Natural Sciences and Engineering Research Council	$64,000
Canada Foundation for Innovation	$2,591,887
Ontario Innovation Trust	$2,591,887
Ontario Research and Development Challenge Fund	$2,000,000
Premier's Research Excellence Award	$150,000 *
Industry/Other Government	$3,148,854

*Two-thirds of each PREA is funded by the province and one-third is provided by the university.

University of Waterloo

Waterloo Centre for Atmospheric Sciences

THE WATERLOO CENTRE for Atmospheric Sciences is a multidisciplinary teaching and research organization that focuses on climate change, air pollution and space and planetary measurements.

Led by Chemistry and Physics Professor James Sloan—who is also the **Natural Sciences and Engineering Research Council** Industrial Research Chair in Atmospheric Sciences—the Centre is seeking solutions to air quality problems ranging from smog in southern Ontario to atmospheric contamination in the Arctic. Currently, urban air pollution and climate change are two of the most important issues under investigation, with evidence indicating that aerosols affect climate as much as or more than greenhouse gases.

To further investigate the complex and little understood influence of clouds and atmospheric particulate matter (aerosols), the Centre is combining laboratory experiments, satellite observations and modelling.

The Centre is also working in partnership with the Ontario Ministry of the Environment and Energy on regional atmospheric modelling to provide scientific information for air quality policy. A proposed partnership with Environment Canada may lead to future model development and support related to U.S.-Canada trans-boundary air issues.

Working with the private sector, the Centre provides modelling tools and expertise regarding motor vehicles, electric power and mining in ways to meet environmental standards. Centre research also supports the environmental consulting industry. Other research projects with external partners include emission inventories, atmospheric mercury, pesticides, laboratory aerosol research and space-based remote sensing for greenhouse gases.

As part of its public outreach, the Centre is a public information resource on current atmospheric issues for the news media and non-governmental organizations. It provides technical support and develops models of interest to regional municipalities in southern Ontario.

The University of Waterloo has developed a new atmospheric and planetary sciences undergraduate program and plans to offer a graduate program and technical short courses in 2004.

Dr. James Sloan and students discuss a new atmospheric model that is being developed with the flow diagram shown on the computer screen.

funding profile

- **Natural Sciences and Engineering Research Council** $4,288,509
- **Ontario Research and Development Challenge Fund** $1,662,500
- **Industry** $1,662,500

Western
Leading. Thinking.

Reducing Catastrophic Loss

ICLR Co-Chairs Dr. Simonovic (left) and Dr. McBean (right)

FOUNDED IN 1998 by Canada's property and casualty insurers, Western's Institute for Catastrophic Loss Reduction (ICLR) is a world-class centre for disaster prevention, committed to improving public awareness about disasters.

Over the last 10 years, natural disasters have killed more than 650,000 people worldwide and caused more than $1 trillion in damage. Disaster damage has doubled every five to seven years since the 1960s. The greatest tragedy is that many disaster losses are preventable. The ICLR's primary mission is to reduce the loss of life and property damage caused by severe weather and earthquakes by developing resilient communities and knowledgeable individuals best able to prevent hazards from becoming disasters. Primary funding is provided by the Insurance Bureau of Canada, the **Ontario Research and Development Challenge Fund** and institutional sources. The work of ICLR researchers is supported by a number of programs, including the **Canada Foundation for Innovation**, the **Ontario Innovation Trust** and the **Natural Sciences and Engineering Research Council**.

The ICLR is led by renowned Western researchers Dr. Gordon McBean, Departments of Political Science and Geography; Dr. Alan Davenport, ILCR founder and Research Director, and Engineering Professor and founder of the Boundary Layer Wind Tunnel at Western; and Dr. Slobodan Simonovic, Faculty of Engineering. The Institute maintains offices in both London and Toronto and provides funding to a wide network of researchers located across Canada.

Collectively, the ICLR team is recognized for its pioneering work in wind and seismic engineering, atmospheric sciences, hydrology and economics. Its primary investigations focus on understanding disaster risk management and prevention; enhancing government science related to natural disasters; and improving community actions for disaster mitigation. Recently, the ICLR partnered with Health Canada to establish a research network to study the social and health impacts of disasters.

The Institute's findings are shared through a publications series and occasional workshops. To raise public awareness about disasters, the ICLR maintains a web site, *www.iclr.org*, with scientific information on a variety of natural hazards including earthquakes, lightning/hail, flood/drought, hurricanes, tornadoes, wildfires and winter storms. The ICLR also offers its services to the business and broader community on a fee-for-service basis. To date, it has conducted contract research on a range of specific projects and undertaken workshops tailored to specific business and academic audiences.

funding profile

- **Natural Sciences and Engineering Research Council** — **$535,000**
- **Ontario Research and Development Challenge Fund** — **$2.5 million**
- **Insurance Bureau of Canada** — **$2.5 million**
- **Institution in kind** — **$2.5 million**

Western
Leading. Thinking.

Investigating the Brain's Visual Systems to Treat Mental Illness

WITH ONGOING SUPPORT from the **Canadian Institutes for Health Research**, the **Natural Sciences and Engineering Research Council**, the **Premier's Research Excellence Awards** program and the EJLB Canada Foundation, Dr. Stefan Everling uses cutting-edge functional Magnetic Resonance Imaging (fMRI) to identify brain regions and neural processes affected by schizophrenia.

Dr. Everling conducts his experiments by exposing individuals to a brief pulse of light. They are instructed to look away from the origin of the pulse, voluntarily suppressing their natural reflex to look toward it. According to previous research, schizophrenic patients have a far higher failure rate in suppressing this reflex than the "normal functioning" control group.

"As a result, my research focuses on two questions: What is the neural circuitry in the brain that controls the suppression of these reflexes and why do schizophrenics have difficulty with this?" says Dr. Everling.

Along with colleagues Dr. Mel Goodale, **Canada Research Chair** in Visual Neuroscience, and Dr. Ravi Menon, Robarts Scientist and **Canada Research Chair** in Functional Neuroimaging, Dr. Everling helped to establish Western's new Centre for Brain and Mind. The Centre, recognized as one of the top laboratories of its kind in North America, was formed to provide a dedicated facility at Western to study cognitive function and dysfunction in the primate brain.

Research at the Centre has enormous clinical importance, providing a framework for understanding perceptual and visuomotor deficits, leading to more efficient clinical diagnosis and rehabilitation. There are potential commercial applications emerging from this research as well. Models of visual function are already being applied to the development of more efficient human-machine interfaces and robotic control systems.

Co-Founders of the Centre for Brain and Mind, Dr. Mel Goodale and Dr. Ravi Menon.

funding profile

Centre for Brain and Mind

Canada Foundation for Innovation	$2.4 million
Ontario Innovation Trust	$2.4 million

Dr. Stefan Everling

Canadian Institutes for Health Research	$2 million
Natural Sciences and Engineering Research Council	$88,000
Canada Foundation for Innovation	$250,000
Ontario Innovation Trust	$250,000
Premier's Research Excellence Award	$150,000 *
EJLB Foundation	$300,000

*Two-thirds of each PREA is funded by the province and one-third is provided by the university.

Western
Leading. Thinking.

Protecting Ontario's Forests

ONE OF TODAY'S most important environmental challenges is the potential for human activity to change the physical, chemical and biological components of ecosystems.

To predict the impact of these changes requires an integration of both modelling and empirical approaches. However, models for evaluating environmental change are being developed at a far greater rate than empirical research. Dr. Irena Creed is one of a small group of scientists working to bridge this gap through research on drainage (catchment) systems.

Dr. Creed uses geographic techniques and information systems, remote sensing and distributed simulation models as the basis for the design of a monitoring system to collect scientific information from these catchments. Subsequently, this data can be scaled to include the entire region.

Dr. Creed has established the Catchment Research Facility (CRF) for advanced monitoring and analytical modelling. The CRF enables researchers to discriminate between ecosystem "signals," resulting from anthropogenic disturbances, and ecosystem "noise," produced by the natural variability of ecosystem dynamics. Once the signal/noise ratio of ecosystem dynamics is established, the impact of disturbance on the ecosystems can be investigated, providing a scientific basis for the development of adaptive management strategies.

Dr. Creed's innovative research has received funding from the **Canada Foundation for Innovation**, the **Ontario Innovation Trust and institutional sources,** the **Premier's Research Excellence Awards** program and the **Ontario Ministry of Natural Resources**. It is also supported by a variety of private-sector companies including Syncrude Canada Ltd., the Alberta Pacific Forest Industries Ltd. and Weyerhaueser Canada Ltd.; and by funding agencies outside Canada, including the U.S. Department of Agriculture and the U.S. Geological Survey. Ongoing support has also been provided by the **Natural Sciences and Engineering Research Council.**

▼ Dr. Irena Creed has designed a monitoring system to evaluate environmental change in drainage systems.

funding profile

◗ Natural Sciences and Engineering Research Council	$1.5 million
◗ Canada Foundation for Innovation	$390,000
◗ Ontario Innovation Trust	$390,000
◗ Premier's Research Excellence Award	$150,000 *
◗ Ontario Ministry of Natural Resources	$100,000

*Two-thirds of each PREA is funded by the province and one-third is provided by the university.

Western
Leading. Thinking.

Tracking and Imaging the Dynamics of Cell Signaling Networks to Fight Cancer

MANY DISEASES, including several forms of cancer, result from the abnormal growth and division of cells. Dr. David Litchfield conducts research defining the molecular events that control cell proliferation. An understanding of these events and how they are altered in cancer cells may lead to improved strategies for the diagnosis and treatment of cancer.

Funded by the **National Cancer Institute of Canada**, the **Canadian Institutes of Health Research**, the **Natural Sciences and Engineering Research Council (NSERC)** and the **Premier's Research Excellence Awards** program, the Litchfield lab focuses on the casein kinase 2 (CK2) family of protein kinases. The precise functions of this family of protein kinases remain poorly defined although we know changes in them are linked to the development of tumours. In fact, CK2 participates in cellular decisions of life and death that become altered in cancer.

Recently, the Litchfield laboratory team discovered proteins that interact with CK2 in cells and characterized a number of regulatory modifications on CK2 itself. Collectively, these discoveries provide new insights into how CK2 is regulated in cells and how it becomes altered in cancer.

With **NSERC** funding , the Litchfield laboratory has also been involved in complementary collaborative studies with the biochemistry labs of Drs. Chris Brandl and Brian Shilton at Western. These studies are focused on a detailed investigation of Pin1, another important component of the regulatory networks that control the life and death of cells.

Dr. Litchfield is also part of a group that received funding from the **Canada Foundation for Innovation, the Ontario Innovation Trust and institutional sources** for instruments and facilities that will accelerate the identification and characterization of the regulatory components of the networks involved in the transmission of regulatory signals. The funding for this infrastructure will allow the group to visualize these regulatory cellular events in living cells, adding an important new dimension to our understanding of how cellular decisions are made and assisting in the fight against cancer.

▼ Dr. David Litchfield is researching the molecular events that control cell proliferation.

funding profile

- **National Cancer Institute of Canada** $665,500
- **Canadian Institutes of Health Research** $577,000
- **Natural Sciences and Engineering Research Council** $258,000
- **Canada Foundation for Innovation** $1.2 million
- **Ontario Innovation Trust** $1.2 million
- **Premier's Research Excellence Award** $150,000 *

*Two-thirds of each PREA is funded by the province and one-third is provided by the university.

Western
Leading. Thinking.

Surface Science Western—Developing Innovative Materials for Industry

OVER THE PAST two decades, Surface Science Western (SSW) has established itself as the most comprehensively equipped surface analytical lab in Canada. SSW is a consulting and research laboratory handling all aspects of material surface properties, with strong research programs in the areas of corrosion and metallurgy, microelectronic materials, polymer chemistry and catalytic reactions. SSW projects have been supported by the **Natural Sciences and Engineering Research Council**, and most recently new infrastructure has been acquired through funding from the **Canada Foundation for Innovation**, the **Ontario Innovation Trust and institutional sources**.

Under the directorship of Dr. Stewart McIntyre, Department of Chemistry, SSW has attracted a growing cohort of researchers from a wide range of disciplines, from earth sciences to microbiology. Currently, about 15 researchers at Western access the lab facilities, as well as academics from across Ontario and Canada.

The laboratory has strong links to industry with upwards of 900 individual research projects conducted annually for more than 150 companies. Since 1980, SSW has attracted more than $20 million in contract research, servicing a vast range of clients from small manufacturing facilities to industrial giants. With these earnings, SSW—which has garnered a solid reputation for quality, innovation and timely service—has been able to fund most of the laboratory's operating expenditures.

Located in the Western Science Centre, student access to the facility is a priority. The lab is designed to incorporate the teaching of surface science into all encounters students have with the instrumentation. They are able to access most facilities easily and staff offices are readily accessible to students operating equipment. Today, approximately 50 graduate students access the facility each year.

David Miller (left), graduate student in Chemistry, and Dr. James Francis, a Surface Science Western researcher, work with a Time-of-Flight Secondary ion Mass Spectrometer that measures the mass of particles emitted from a solid surface.

funding profile

Natural Sciences and Engineering Research Council	$1.5 million
Canada Foundation for Innovation	$920,000
Ontario Innovation Trust	$920,000

Wilfrid Laurier University

The Algorithms of Financial Risk

LEADING FINANCIAL ENTITIES worldwide, from insurance companies to banks, apply mathematical techniques used in theoretical physics and probability theory to develop financial models. But, as Dr. Giuseppe (Joe) Campolieti explains, the models are far from perfect.

"What is a firm's risk exposure," asks the Wilfrid Laurier Professor of Financial Mathematics, "given shifts in market variables from one day to the next? That's an important question in risk management."

Traditionally, economists use the Black-Scholes model (which calculates the price of a standard option contract based on current time and stock price) to infer the behaviour of the market in terms of high or low volatility. But financial mathematicians today use more sophisticated mathematical models and computer simulations for derivatives pricing.

Dr. Giuseppe (Joe) Campolieti is developing new algorithms for the financial marketplace.

Dr. Campolieti is creating new algorithms to address problems with complex derivative contracts (exotic options such as barrier options and early exercise contracts). He hopes his research will better explain inconsistencies in the marketplace by building upon current models and techniques and, ultimately, will result in new mathematical models and techniques for pricing financial derivatives that will help traders and banks manage risk and develop new trading strategies.

"It's a global phenomenon," says Dr. Campolieti. "Banks now hire theoretical financial analysts to develop algorithms."

A high-speed computer network known as the Shared Hierarchical Academic Research Computing Network—or SHARC-NET—allows Dr. Campolieti, who holds a SHARC-NET Research Chair, to run computer simulations that would otherwise be impossible. SHARC-NET is funded by the **Canada Foundation for Innovation**, the **Ontario Innovation Trust** and the **Ontario Research and Development Challenge Fund**.

The network is valued at $42 million and connects the universities of Guelph, McMaster, Western Ontario, Windsor and Wilfrid Laurier, as well as Sheridan and Fanshaw colleges.

funding profile

◗ Natural Sciences and Engineering Research Council	$56,000
◗ SHARC-NET Chair	$70,000
◗ SHARC-NET Fellowships	$56,700

Wilfrid Laurier University

Building Better Laser Products

WHILE THE SCIENCE of semiconductor laser diodes is foreign to most people, the components and their everyday uses are widely recognized. The components are essential parts of such everyday tools as laser printers, compact disc players and fibre-optic communication transmitters. Dr. Marek Wartak's research—involving vertical-cavity surface emitting lasers, or VCSEL—represents a new class of semiconductor lasers and introduces enormous progress in this field.

Dr. Wartak's research involves the modelling, design and, more specifically, the simulation of semiconductor lasers. His research attempts to simplify the fabrication process of new products by computerizing the procedure and making it more reliable. His ultimate goal, however, is to improve telecommunication applications.

"What we have created is the main tool that drives faster Internet," says Dr. Wartak. "The improvement of these lasers means the signal is faster, which is important internationally for communication purposes."

The models involved in Dr. Wartak's most recent explorations will describe the heating effects in long-wavelength VCSELs that are used to analyze and optimize the devices. Previous observations show that heating VCSELs during operation affects threshold current as well as output power.

An added benefit of the research is an eventual reduction of costs—not only in future developments, but also for the average consumer of products that use these semiconductor lasers. Reducing the time it takes to fabricate the devices will lower the price of everyday products.

Dr. Marek Wartak's research into semiconductor lasers may lead to a faster Internet.

funding profile

- Natural Sciences and Engineering Research Council $77,200
- SHARC-NET Fellowships $66,700
- Photonics Research Ontario (Ontario Centre of Excellence) $40,000

Wilfrid Laurier University

Improving Children's Memory and Testimony

FEDERAL AND PROVINCIAL funding has allowed Dr. Kim Roberts to expand her studies into the memory processes of young children. While children may remember what has happened to them, they frequently get confused between different incidents.

"It becomes crucial forensically," says Dr. Roberts. "Even though children may remember the gist, it's the fine details that determine if an offender is prosecuted."

Currently there are no national guidelines for police who interview victims of repeat abuse, making prosecution difficult. Children's confusions about time, place and specific actions are targeted on cross examination.

Dr. Roberts examines how police extract memories from multiple abuse victims, and is developing a police interview technique to help children correct their errors. Other research objectives include identifying the skills that are necessary to prevent confusion and the age range where children master these skills.

Children in the study are three to 10 years old. They will experience similar events and will later be tested on their memory as well as their ability to recognize their own errors and adopt new strategies to remember.

"Identifying factors that are responsible for errors will help provide the police with the tools necessary to collect accurate children's eyewitness accounts," she explains. "Ultimately this leads to a fairer justice system for child victims."

Dr. Roberts' grants provide a stipend to two undergraduate students and two graduate students. They are also funding the construction of a computer and audiovisual laboratory to test memory.

Dr. Kim Roberts is working to develop an interview technique that will help children remember details.

funding profile

Natural Sciences and Engineering Research Council	$80,000
Canada Foundation for Innovation (jointly with Anne Wilson)	$52,390
Ontario Innovation Trust	$52,390
Premier's Research Excellence Award	$150,000 *

*Two-thirds of each PREA is funded by the province and one-third is provided by the university.

Wilfrid Laurier University

Preserving Our Oral History

PROFESSOR OF ENGLISH Robin Waugh feels an urgent need to protect oral performances. "We need to collect oral stories because representatives of fading cultures will not be around forever," he explains. "Once they're gone, they're gone for good."

Dr. Waugh has established an oral studies research studio at Wilfrid Laurier University that includes sound and video recording equipment, along with editing tools, to record performances of oral stories from traditions and cultures across Canada.

A web site complementing the studio will collect, preserve and analyze these stories and offer research from disciplines as diverse as anthropology, film and religion. It will also include interactive materials, such as translations, analytical searches and detailed examinations of oral performances.

The site will contribute to the economic life of the Kitchener-Waterloo community by offering recordings of artists and writers at local venues. Dr. Waugh also hopes to forge relationships with public and private television and radio broadcasters that produce news.

The equipment will help to further Dr. Waugh's own comparative analysis of medieval oral performances and their present-day counterparts. Other faculty are also using the equipment for their research. Currently, one researcher is using the studio to examine the oral history of 19th- and 20th-century native missionary relations in British Columbia; another faculty member is examining the oral traditions of religion in Africa and the Caribbean.

"Oral performances are interesting and complex pieces of artistry that involve our senses," says Dr. Waugh. "By continually documenting them, we are ensuring they can be enjoyed by generations of Canadians."

funding profile

Canada Foundation for Innovation	$80,704
Ontario Innovation Trust	$80,704

Dr. Robin Waugh's recording studio at Wilfrid Laurier will ensure the preservation of stories from the past.

Wilfrid Laurier University

Keeping Athletes and the Elderly on the Move

WILFRID LAURIER RESEARCHERS Peter Tiidus and Stephen Perry are using provincial and federal funding to help a large cross-section of people—from athletes to the elderly—stay on their feet.

Dr. Tiidus and Dr. Perry have used grants from the **Canada Foundation for Innovation** and the **Ontario Innovation Trust** to purchase equipment to test balance, energy loss and walking patterns. This equipment includes a dynamometer, used for measuring muscle forces during different contractions, and a portable metabolic system that records such levels as metabolism and oxygen consumption in active subjects.

Dr. Stephen Perry with some of the specialized research equipment that is used to test balance and walking patterns.

Dr. Tiidus uses the equipment to examine the exercise routines of men and women, with a particular interest in post-menopausal women who face rapid muscle mass loss and reduced strength. As these women age, they are susceptible to injuries due to falling. He also investigates muscle repair and muscle function after weight training to see if massage or ultrasound techniques are effective treatments for muscle recovery.

Meanwhile, Dr. Perry continues his study of the motions, vibrations and forces associated with falling and the elderly. His research could eventually lead to the design of a shoe insole that helps elderly people regain some sensitivity in their feet.

"As the Canadian population ages, it's important to invest in research that helps the elderly maintain an independent and functional lifestyle," says Dr. Tiidus. "It's hoped that the funding of this research can contribute to that."

In performing this research, the investigators have interacted with health providers and organizations, such as the YWCA, fibromyalgia patient support groups, senior groups and message therapists, that help spread practical information to those in need.

Two research associates and at least five undergraduate students have learned to use the new equipment to assist with their studies.

funding profile

◗ Canada Foundation for Innovation	$123,882
◗ Ontario Innovation Trust	$123,882

UNIVERSITY OF
WINDSOR

Metabolic Biotransformation of Aquatic Wildlife

DR. ROBERT LETCHER is an Assistant Professor and **Canada Research Chair** in the Department of Chemistry and Biochemistry and the Great Lakes Institute for Environmental Research at the University of Windsor. He is studying the role of metabolism—the process of breaking down chemicals—in the environmental chemistry and toxicology of established and emerging organic pollutants such as polychlorinated biphenyls, pesticides, flame-retarding compounds and drugs in aquatic organisms and their ecosystems. A variety of aquatic organisms are studied, including fish, frogs, fish-eating birds, marine mammals, polar bears and humans.

Enzyme systems exist in all organisms to metabolize and detoxify chemicals that are potentially dangerous to the body. The capacity of an organism to break down chemicals will determine how available the chemical is to the organism, and how effectively it will accumulate in the body. These enzyme processes can actually convert organic pollutants into new chemical forms that may accumulate in the body with the potential to be more toxic than the original form of the chemical.

Many metabolic processes result in the addition of oxygen to organic pollutants. These oxygen-containing chemicals, which are called metabolites, can simulate hormones in the body or influence hormone-dependent processes, and can affect the development and reproduction of an organism. These metabolites can also be toxic and a source of "oxidative stress" that can lead to cancer, for example, in an organism.

Dr. Letcher's research has contributed to a greater understanding of the relationship between metabolism and the fate and toxicities of potentially hormone-like and cancer-causing organic pollutants. Students in Dr. Letcher's research group are learning a wide array of new analytical and bioanalytical techniques and methods, and discovering the interdisciplinary relationship between the chemistry, biochemistry, metabolism, toxicology, pharmacology and endocrinology of environmental pollutants.

Dr. Robert Letcher is studying the metabolism of pollutants.

funding profile

Canada Research Chair	$500,000
Canada Foundation for Innovation	$128,393
Ontario Innovation Trust	$128,393
Premier's Research Excellence Award	$150,000 *

*Two-thirds of each PREA is funded by the province and one-third is provided by the university.

UNIVERSITY OF
WINDSOR

Integrated Light Metal and Composite High Pressure Casting Research Laboratory

Dr. Henry Hu's state-of-the-art laboratory gives Canada's automotive industry a competitive edge.

DR. HENRY HU of the Department of Mechanical, Automotive and Materials Engineering is enjoying the success of his **Canada Foundation for Innovation** and **Ontario Innovation Trust** awards—an integrated light metal and composite high pressure casting laboratory. The one-of-a-kind research facility in Canada includes partnerships with the automotive and value-added manufacturing industries—two of Canada's most important industries.

Dr. Hu's laboratory provides state-of-the-art equipment and a practical engineering environment that will be used to validate the existing solidification theories and model, to develop castable lightweight alloys and composites and to advance real-time process control and casting techniques.

It is expected that the facility's light metals casting technology and its application will increase the competitive capability of Canada's automotive industry significantly, especially since automakers are turning more and more to light alloys due to their weight savings, fuel economy, recyclable nature and part consolidation. In addition, advanced powertrain design and manufacturing capabilities will enable the facility to respond to the sector's critical demand for high-efficient/low-cost engines and transmissions.

This leading-edge research facility establishes the University of Windsor as a national automotive engineering research leader. It will not only attract highly qualified personnel to the University of Windsor and provide training opportunities for future researchers and highly skilled workers in those vital manufacturing areas, but also promote university-industry partnerships with regional and national automotive and supply companies.

funding profile

Canada Foundation for Innovation	$231,500
Ontario Innovation Trust	$231,500

UNIVERSITY OF
WINDSOR

The ProbeFusion Project

Dr. Phil Graniero's research focuses on geospatial data collection.

QUESTIONS OF SPATIAL heterogenity, patterns and structures in hydrologically governed systems are a key focus of research in the University of Windsor's Multi-purpose Environmental Modelling Facility (MEMF).

Dr. Phil Graniero, an Associate Professor in the university's Earth Sciences Department, is a core member of MEMF and also belongs to the Great Lakes Institute for Environmental Research. An expert in sampling strategies and geospatial data acquisition methods for geographic information systems and environmental modelling, Dr. Graniero also has significant experience in the development of decision-support systems incorporating reasoning methods.

Under Dr. Graniero's leadership, MEMF has produced ProbeFusion, a software system designed for highly flexible geospatial data collection activities. It can be configured to accept data from an unlimited range of geospatial and environmental probes. The incoming data can be merged into custom data records and sent to a broad range of destinations including files, databases, other devices or even other program modules running concurrently with ProbeFusion.

For field operations, ProbeFusion is run on a tablet-style touch screen computer that can handle extreme environmental conditions such as intense rainfall, blowing dust and freezing temperatures. A global positioning system (GPS) receiver is mounted to a field backpack to accurately place the measurements in space and time. A datalogger is also mounted to the backpack, along with a number of sensors for measuring soil properties, water quality or microclimate conditions.

MEMF has received funding from **CRESTech** (an **Ontario Centre of Excellence**) and Conestoga-Rovers and Associates (CRA), to develop a real-time environmental monitoring system based on ProbeFusion, CRA's OpenRTU remote process monitor and radio technology. Equipped with a radio modem, a ProbeFusion data collector can broadcast the data (simultaneously with collection) to a base station, which checks data integrity and sends the record to its final destination, including remote databases via Internet connections.

Field tests were conducted during the summer of 2002 in Waterloo and at Point Pelee National Park. Three different environmental databases were updated simultaneously, receiving data from multiple data collectors. It took less than one second from the time of measurement to the data being available in a GIS-capable database.

With a ProbeFusion system, environmental and resource monitoring may be conducted more intensively and with less infrastructure than a typical permanent network of sensors.

funding profile

◗ Centre for Research in Earth and Space Technology (Ontario Centre of Excellence)	$68,588
◗ Conestoga-Rovers and Associates	$50,700

UNIVERSITY OF
WINDSOR

Fish Harvesting and Culture Result in Genetic Changes in Commercial Species

ALTHOUGH WE EXPECT the practice of aquaculture—the domestication and captive rearing of fish—to drive genetic change in fish populations, evidence is growing that commercial and sport fishing may also be bringing unexpected genetic effects to Canada's wild fish populations. However, these changes are not quite as intuitive as those resulting from aquaculture—no one is intentionally "selecting" fish for specific attributes (such as fast growth or high survival).

The University of Windsor's Dr. Daniel Heath has researched the impact of human activities on fish genetics for most of his academic career, and before that worked in the salmon farming industry in British Columbia. This combination of commercial and academic perspectives enables Dr. Heath to address key questions regarding fish resource management.

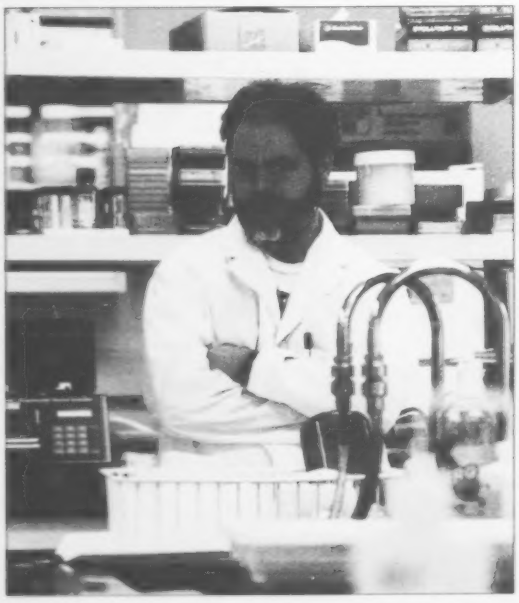
Currently Dr. Heath is working on a number of projects involving population genetics in natural populations of commercially important fish species. One project focuses on the relationship between genetic diversity and population well-being of walleye fish from upland Ontario lakes. This project, run in collaboration with the Ontario Ministry of Natural Resources, will research over 50 lakes and provide a powerful dataset to determine the potential role of overfishing and inbreeding in population stability and long-term viability.

Another project researching the Detroit River has shown that a common class of aquatic contaminants (PAHs) is affecting the genetic pathway for tumour formation in a bottom-dwelling fish species (brown bullhead).

A third project, still in the planning stage, will examine lake trout DNA taken from scales collected in Lake Superior over 60 years ago, to test for changes in the immune function genes, perhaps driven by the sea lamprey invasion and proliferation.

With nine graduate students, a number of undergraduate students, two postdoctoral fellows and a full-time technician, Dr. Heath's lab is providing advanced training for future academics and industry personnel.

▼ Dr. Daniel Heath is investigating the effect of human activity on fish genetics.



funding profile

Canada Research Chair	$500,000
Canada Foundation for Innovation	$125,000
Ontario Innovation Trust	$125,000
Premier's Research Excellence Award	$150,000 *

*Two-thirds of each PREA is funded by the province and one-third is provided by the university.

UNIVERSITY OF
WINDSOR

Cancer Research Laboratory and Spatial Modelling of Environmental and Occupational Determinants of Health

SOUTHWESTERN ONTARIO, especially the Windsor-Sarnia area, experiences serious environmental exposure problems, with anecdotal evidence suggesting higher mortality rates compared to the rest of Ontario and Canada. Its large industrial area makes it a high pollution zone, and yet the possible spatial concentration of potential impact has not been investigated.

A new environmental research facility at the University of Windsor, led by Dr. Isaac Luginaah of the Department of Sociology and Anthropology, will respond to the critical need for environmental research in southwestern Ontario through three major but interrelated initiatives. Each project will aim to develop theory and methods that will inform environmental and population health policy.

The first initiative will focus on the relationship between environmental quality and health in this region, with its goal being the development of theory and methods that will integrate research in this area. This infrastructure will be used to identify the spatial dimensions of particulate and gaseous pollution concentrates in relation to specific socioeconomic and vulnerable groups. Accurately estimating impact zones for both particulate and gaseous pollutants will strengthen the methodology used in assessing health effects and lead to more policy-relevant findings.

Dr. Isaac Luginaah is responding to the critical need for environmental research in southwestern Ontario.

The second initiative will be a research program centred around cancer and occupational health research. Dr. Luginaah's facility will host an integrated relational database for cancer research in both Canada and the United States that will enable researchers in and outside of Ontario to do extensive cancer research.

The third initiative will lead to the development of a database to collect occupational histories of cancer patients in southwestern Ontario. Historically, cancer treatment centres in Canada have not collected the occupational histories of its patients. Because of this omission, occupational cancer research has been limited to data obtained from death certificates or records indicating predominant occupation. To address this oversight, a multidisciplinary team has developed a computerized questionnaire called the Lifetime Occupational History Registry (LOHR) that captures, through interviews with cancer patients at the Windsor Regional Cancer Centre, data regarding their history of work, environmental, residential, lifestyle and other risks factors. Researchers at Dr. Luginaah's facility intend to modify and enhance the LOHR to include additional cofounders such as non-work activity levels and dietary history.

This database, the first of its kind in Canada, will offer researchers and other community partners the opportunity to access data regarding the relationship between occupational exposure and cancer.

funding profile

Canada Foundation for Innovation	$75,176
Ontario Innovation Trust	$75,176

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Globalization and the Creative City

Dr. Janine Marchessault is examining the impact of globalization on the contemporary artist.

CONTINUED GLOBALIZATION has intensified the role of the artist in the design and creation of new information technologies and new media. But does globalization truly benefit contemporary artists and the communities they forge?

Dr. Janine Marchessault, York University's **Canada Research Chair** in Art, Digital Media and Globalization, is exploring this important question, examining how artists in different cities have contributed to the development of new information landscapes, from parks to virtual spaces on the Internet. She is working to develop a new media lab, a space where graduate students can document and study how artists adapt and use space, both real and virtual, for their own purposes. Dr. Marchessault is currently investigating 401 Richmond Street in Toronto, a property that demonstrates how artists, responding to government funding reductions, have reclaimed an old warehouse to support a highly collaborative network of galleries, designers, small presses and production houses. For Dr. Marchessault, this represents the new articulation of urban civil society that she is looking to examine in a variety of city contexts.

And while highlighting how globalization has benefited some artists, Dr. Marchessault's work also provides an important critique of corporate capitalism, as well as the digital divide between those who have access to new media technologies and those who don't. She is the editor of the journal *Public* and recently completed a book on Marshall MacLuhan called *Cosmic Media*.

funding profile

Canada Research Chair	$500,000
Canada Foundation for Innovation	$121,500
Ontario Innovation Trust	$121,500

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Solving SARS with Math

THE RECENT SARS crisis was a frightening reminder of how globalization has made the world a dangerously small place. But how can mathematics help us to better understand and control the spread of deadly infectious diseases throughout the world's urban system? Prof. Jianhong Wu, York University's **Canada Research Chair** in Applied Mathematics, is currently leading a national team of experts to seek answers to this question, while York University in tandem is focusing strategic research efforts on infectious diseases.

An expert in the mathematical modelling of ecosystems and nonlinear analysis, Professor Wu is directing the effort to model the transmission patterns and dynamics of diseases such as SARS from a mathematical and statistical perspective. With the help of York's Office of the Vice-President Research and Innovation and in co-ordination with Mathematics of Information Technology and Complex Systems (associated with the **Network of Centres of Excellence**), Professor Wu quickly assembled a national team of 19 mathematicians, virologists, infectious disease experts and leading public health scientists to map the spread of SARS. Five members of the team are from York. Using compartmental models and complex computer simulations to track and predict the pattern of infection, Professor Wu and his diverse team will be positioned to make recommendations for public health policy. Members of the team are already starting to build comparison models to better understand the spread of anthrax, HIV, malaria and West Nile virus.

This vital work will ultimately help Canada build and sustain a permanent network of researchers focusing on the problem of infectious disease—illustrative of York's strong interdisciplinary focus and commitment to solving real-world problems.

Prof. Jianhong Wu has assembled a research team to study the spread of infectious diseases such as SARS.

funding profile

Canada Research Chair	$1.4 million
Natural Sciences and Engineering Research Council	$34,000
Mathematics of Information Technology and Complex Systems (Networks of Centres of Excellence)	$16,000
Canada Foundation for Innovation	$55,111
Ontario Innovation Trust	$55,111

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Fighting HIV with Pokeweed

THOUGH HUMOROUSLY NAMED, the pokeweed may just prove to be one of the most effective weapons against HIV. This obscure plant, native to shaded environments in the southern regions of Canada and the United States, contains a protein with unique antiviral potential. Prof. Katalin Hudak, of York University's Faculty of Pure and Applied Science, is one of a mere handful of scientists in the world currently studying the possible benefits of this curious plant.

Researchers have been aware of the pokeweed antiviral protein (PAP) since 1928, but are only just discovering how this protein actually targets and kills viruses. Traditionally, scientists believed that the antiviral property of the protein would limit virus proliferation by destroying the host cell. However, studies since the early '90s have begun to suggest that the antiviral activity of PAP is separate from its toxicity, given that it is capable of limiting the spread of HIV without killing its host cell. In fact, PAP is already being used as a therapeutic drug against HIV in South Africa.

Professor Hudak's study of how PAP targets viruses is currently the only substantial one of its kind in Canada, and her findings may aid in the design of novel antiviral agents. Her research is an example of York University's strength in biotechnology.

Prof. Katalin Hudak is exploring the antiviral properties of the pokeweed plant—a potential treatment for HIV.

funding profile

Natural Sciences and Engineering Research Council	$152,000
Canadian Institutes of Health Research	$5,000
Canada Foundation for Innovation	$200,297
Ontario Innovation Trust	$200,297
Premier's Research Excellence Award	$150,000 *

*Two-thirds of each PREA is funded by the province and one-third is provided by the university.

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Managing North America's Lakes

ALTHOUGH ONTARIO CONTAINS over 250,000 lakes, these little wet pockets of life and evolution are, for the most part, only 10,000 years old. In recent years, however, mankind has interfered extensively with the natural world, disturbing the delicate balance of ecosystems in a variety of ways, from fishing to polluting. But what exactly is the extent of this damage? And can these lakes recover?

Recipient of a **Premier's Research Excellence Award**, Norman Yan, Professor of Biology in the Faculty of Pure and Applied Sciences, has spent the last 30 years attempting to answer these questions, quantifying the single and joint effect of multiple stressors—both natural and man-made—on these lakes.

Through a collaboration between York University and the Ontario Ministry of the Environment, Professor Yan works on questions that are of vital importance to the management of North America's lakes, exploring the impact that acid rain, ultraviolet radiation, climate change and invading species pose to the natural world. He heads a team of students who conduct field experiments. Most recently, these have included assessing whether decreasing calcium levels are having a negative impact on the ecosystems in lakes, and whether invading species have affected animal plankton. He also investigates the pace of recovery of some of these ecosystems.

With the Ministry of the Environment and the support of the **Canada Foundation for Innovation** and the **Ontario Innovation Trust**, Professor Yan has helped to develop the Field Laboratory for the Assessment of Multiple Ecological Stressors, a lab that will support up to six students.

North American lakes and the stressors that effect their ecosystems are the focus of Prof. Norman Yan's research.

funding profile

Natural Sciences and Engineering Research Council,	
—Discovery Grant	**$166,000**
—Equipment Grants	**$9,800**
	$28,000
Canada Foundation for Innovation,	
—Infrastructure Operating Grant	**$54,000**
—New Opportunities Grant	**$202,447**
Ontario Innovation Trust	**$202,447**
Premier's Research Excellence Award	**$150,000** *
Ministry of the Environment	**$90,000**
EJLB Foundation	**$25,000**

*Two-thirds of each PREA is funded by the province and one-third is provided by the university.

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Investigating the Mysteries of Climate Change

Prof. Spiros Pagiatakis is using 50-year-old gravity data to study climate change today.

AS CONCERN FOR global warming intensifies throughout the world, studies that research climate change are becoming increasingly important. Although global warming is usually regarded as a contemporary problem, Spiros Pagiatakis, Professor of Geodesy and Geomatics Engineering at York University, has focused his attention upon the distant past to better understand the mysteries of climate change.

Many tens of thousands of years ago, an extremely cold period in our planet's history caused a gigantic layer of ice, several kilometres thick, to accumulate across the polar regions—a layer of ice that depressed parts of the Earth's crust nearly 500 metres. However, a climate change 12,000 years ago, melted much of this ice and, since then, the previously depressed crust has been rising at a rate of approximately one centimetre per year. This phenomenon is known as the postglacial rebound.

Boldly using measurements of gravity taken over the last 50 years—measurements never intended to aid in studying this phenomenon—Professor Pagiatakis is attempting to better understand the postglacial rebound and, by extension, the interior structure of the planet. Ultimately, this research may help scientists determine just how much ice once covered the Earth—knowledge that could improve our current grasp of climate change and global warming.

Professor Pagiatakis' work is interdisciplinary, encompassing fields such as geology and geophysics—reinforcing York University as a leader in space science, environmental and sustainability research.

funding profile

Natural Sciences and Engineering Research Council	$100,000
Geomatics for Informed Decisions (Networks of Centres of Excellence) —	$25,000
Canada Foundation for Innovation	$184,059
Ontario Innovation Trust	$184,059

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